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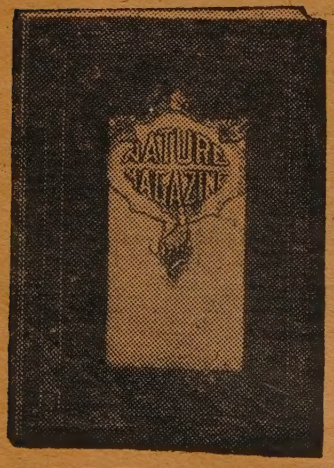

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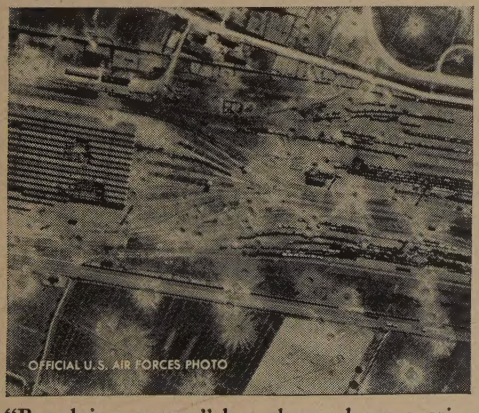

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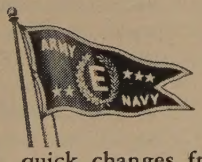

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Nature in Print

By HOWARD ZAHNISER

PERCY THAYER BLOGG has recently published a book (which I have not seen) entitled *There Are No Dull Dark Days.* My wife has illuminated a dim space of her kitchen wall by mounting on it the front cover of the book's advertising leaflet. Nightly now, as I drink milk and stuff my mouth with crackers, I come under the influence of this optimistic title and the colored illustration below it. Beneath an overcast sky a red sunset illumines a rustic covered bridge, makes bright the green foliage of trees along the stream, and reveals the reflections of stream bank, trees, and bridge in the quiet pool between the bridge and me. The bright sunset has all but obscured the dull dark sky.

So Thomas Barbour, writing a book that he calls *That Vanishing Eden: A Naturalist's Florida,* makes the lingering beauties of what he assumes is a sunset seem so alluring that they all but obscure the foreboding of his title. Writing leisurely, conversationally, often reminiscently, often descriptively, sometimes critically, Dr. Barbour succeeds remarkably well in sharing with his reader his impressions of Florida after half a century. The attractions of Florida may be going, going, but they are not gone. There are still hopes for the Everglades. There are advances in wildlife conservation, the egrets and some other birds being better off than they were a generation ago. Dr. Barbour is aware of all these developments, as well as the threats, and he still seems as much interested in sunrises as in sunsets. His book is brighter and livelier than his title.

"I set out the other morning just at sunrise," he writes, "to walk through a beautiful hammock in northern Florida. There had been torrential showers during the night, but dawn had come with the air absolutely still. Just as the sun rose into a cloudless sky, its rays searching out every open spot in the canopy of woods, a sudden breeze sprang up and the leaves began to shed the droplets which they had carried during the night. The effect was so lovely and so surprising that I stood still and caught my breath. It was as if a hard rain were coming down, with the sun shining from the horizon and the sky without a cloud."

On the preceding page Dr. Barbour has recorded the fact that Florida "contains no less than 3512 species of plants" and an authoritative opinion that "there are 314 species which may be justifiably classified as trees." On the following page he tells of lilies that had "unfolded, been fertilized, set seed, and withered, all within the space of a couple of hours," and immediately begins to tell why the University of Florida is "the best equipped in North America to teach fresh-water biology out of doors." This is the delightful sort of book *That Vanishing Eden* is. And, incidentally, Dr. Barbour's explanation of the University's advantages is so convincing that two pages later he concludes the discussion more boldly than he began: "I will go so far as to say that no university in the world is so well placed for the study of fresh water biology as the University of Florida—unless, perhaps, it be Judson College at Rangoon."

This is as good a book as I know for acquiring pleasantly and informally a knowledge and appreciation of a State or region. I wish we could have a series of such books, but that would mean a series of Thomas Barbours and unfortunately there is only one. Here are his chapter headings: The First to Arrive, Bartram's Florida, Mounds, Seminoles, The Norther and the Hurricane, Forests and Fire, Camping, Beaches and Sponges, Springs and Lakes, Mammals, The Florida Ditches, The Garden of Eden, Alligators and Crocodiles, The Islands and the Keys, The Kampong (a chapter about David Fairchild and his Florida home, which gives the chapter its title), The Fairchild Tropical Garden, The Everglades National Park, The Future.

The morning after my own first (and only) arrival in Florida, when out along the water's edge at half past six I heard for the first time the limpkin yell and saw anhingas swimming submerged with only their heads like snakes above the surface, I felt indeed like a far traveler to a strange world. I had just come from the deep delta of the Mississippi in Louisiana, where men and other land creatures keep dry by the grace of a few inches. If ever I could call any part of my native land "exotic" it could only be Louisiana and Florida, and now in the providence of book publishers I have, at the same time, Thomas Barbour's book on Florida and a new volume by Harnett T. Kane entitled *Deep Delta Country,* a book on lower Louisiana in the American Folkways series that Erskine Caldwell is editing for Duell, Sloan & Pearce. And as I lay aside *That Vanishing Eden* I find that Mr. Kane's first chapter is entitled "Paradise Incomplete."

"A philosophic friend, who digs oysters for a living," writes Mr. Kane, "tells about it in this way: Le Dieu Seigneur, the Lord God, had a light mood and decided to create a new paradise on earth. Not with a wave of the hand as He did in the case of the Garden of Eden, but after a more delicate fashion, setting up something that would extend itself over the ages. By design or through forgetfulness—or perhaps because He chose the undependable Mississippi for the purpose—the task was never quite finished. So it remains, a disturbing, ever-changing place, no nearer completion today than it ever was."

My own journal explains to me now, as Biologist Johnny Lynch once explained for the journal, that the river at the delta first forms banks or natural levees, then breaks through these, into a "pass," and starts the palmation of a sub-delta. When the distance through the sub-delta from river to Gulf becomes so great that the current loses its force at the delta's end, the water as it reaches the Gulf becomes sluggish, silt deposit tends to close up the delta, and the river finds a shorter outlet for itself. The sub-delta is formed. It would then, in the course of years, subside, but for the action of the Gulf, which washes up on the Gulf edge of the new land the material that the river has brought down. "The river furnishes the material and the Gulf the labor."

On this fascinatingly created land, where creation is always current, and almost visible, the lives of the folks who have lived there and the inhabitants themselves have also become fascinatingly different, and their folkways are, I believe, unique. Harnett T. Kane has written with such knowledge and understanding and gusto that his book becomes almost as fascinating as the delta itself with its peculiar peoples that are precious to know.

Mr. Kane is, of course, not writing a discussion of geography or of fauna and flora, but all these are so much a part of the delta folkways that a reader of *Deep Delta Country* has a feeling for them that no treatises can impart. His accounts of the human happenings of the past in this land, his descriptions of the river, his characterizations of those who live on the delta and the pilots who take the ocean-going vessels up and down

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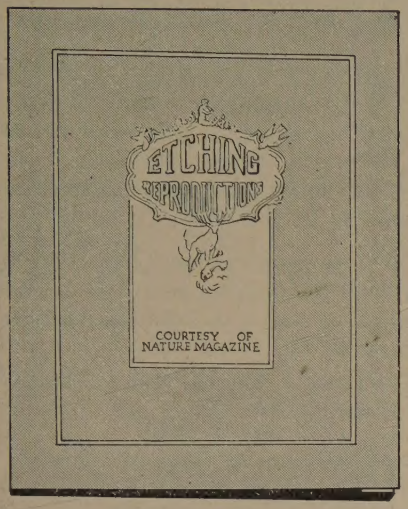

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the changing river, and best of all his narratives of the delta folklore all combine in eloquence to make a rare book. I wish that Mr. Kane could have had the privilege I had of spending a week with the biologists at the Delta National Wildlife Refuge (as, of course, he may have), but I wish even more that I myself had had with me a copy of *Deep Delta Country* to read during the evenings or the damp morning hours I spent there drinking the chicory brew that is, for some strange reason, called coffee.

With such books at hand there are indeed "no dull dark days."

That Vanishing Eden: A Naturalist's Florida. By Thomas Barbour. An Atlantic Monthly Press Book. Boston: Little, Brown and Company. 1944. 250 pp., with 26 photographs on 16 plates and index. $3.

Deep Delta Country. By Harnett T. Kane. New York: Duell, Sloan & Pearce. 1944. 283 pp., with end-paper map, selected bibliography, and index. $3.

The Ways of Evolution

Tempo and Mode in Evolution. By George Gaylord Simpson, New York. 1944. Columbia University Press. 237 pages. $3.50.

Paleontology and genetics are specialized fields of science that have contributed most to charting the evolutionary courses of natural species. In this book, therefore, Dr. Simpson turns to these fields to synthesize the data they have supplied, and to analyze them under two headings, which provide the title to his book. First is tempo, which includes the rate of evolution under conditions of Nature, measurement and interpretation of rates, the reasons for rapid or slow evolution, and other factors affecting the evolutionary process. Under mode, Dr. Simpson is concerned with genetic and morphological differences between populations, and the way in which these come about. This book is one for the scientist in the fields of paleontology, genetics and evolution.—R. W. W.

British Flowers

Flowers in Britain. By L. J. F. Brimble, New York. 1945. The Macmillan Company, 393 pages. Illustrated, including 17 color plates. $4.50.

This book is intended for anyone interested in the flowering plants of Great Britain. In planning his text the author assumes no previous knowledge of botany on the part of his readers, so has included an introduction dealing with the form and structure of plants. His chapters are devoted to families of plants, and the author deals both with wild and cultivated flowers.

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April Authors

John Lindsey Blackford lives in Libby, Montana, and is a gifted young writer-naturalist who can find material for his eloquent pen both in his home mountains and afield. . . . Wilfrid S. Bronson is an artist and author specializing in Nature work. He has several books to his credit, mostly in the juvenile field. . . . Lester Rowntree is a California horticulturist of Carmel, California, specializing in wildflower seeds. She is the author of many articles and two books. . . . Paul H. Oehser is editor at the Smithsonian Institution, Washington, D. C. . . . Anne Faries-Smith is a free-lance writer with a particular affection for wildlife. . . . Myron Gordon is Assistant Curator of Fishes at the Aquarium of the New York Zoological Society. . . . Ellsworth Jaeger is in charge of education at the Buffalo, New York, Museum of Science. . . . Earnest L. Lutz is a retired Seventh Day Adventist missionary now living in California.

Film Strips

Several film strips of particular interest to Nature students are now available from the American Council on Education, Washington 6, D. C. In all, the Council has produced and has for distribution thirty-three strips, originally prepared for circulation in cooperation with the Office of the Coordinator of Inter-American Affairs. They have proved so valuable in carrying the message of North America to sister republics to the South, that it is felt they may well do some educating at home. Beside six strips dealing with six physical and climatic regions of the United States, those on the forests of the United States, the rivers, soil conservation, and the national parks are of special interest to our readers. The strips are available at $1.50 each, and information about them may be obtained from the American Council on Education.

Indiana Looks Ahead

The Indiana Department of Conservation, in common with most other agencies concerned with conservation, has plans for a long-range postwar program. The Department has, however, gone further than most agencies and reduced its plans to writing and the printed word. In a booklet entitled "Outdoor Indiana of the Future," a concise picture of the Hoosier State's needs is presented.

Garden Prizes

A total of $2,500 in prizes in the Green Thumb Contest for 1945 has been announced by the National Victory Garden Institute, 598 Madison Avenue, New York 22, New York. There will be a first award of one thousand dollars for the grand national winner. Other prizes will be by classes. The rules and information may be obtained from the Institute.

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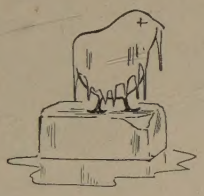
Contents Noted

EVERY Easter uncounted numbers of baby chicks and ducklings are doomed to a lingering death because thoughtless adults think that it would be cute, and appropriate to the occasion, for little Thelma or Larry to have a live pet. Other legions of chicks and ducklings die in the stores, before and after the joyous Eastertime. This racket and the sale of lacquered and lettered baby turtles have always seemed to us inexcusable in a so-called enlightened age. We hope that the "freeze" of fowl will seriously affect this practice in 1945, and we trust that other cities will follow the lead of Chicago in seeking to put a stop to it entirely. The Windy City has amended its Municipal Code to prohibit the sale, barter or gift "of living baby chicks, ducklings or other fowl unless proper brooder facilities are provided. . . ." Such luxuries as a brooder are not likely to be found in the stores where the juvenile birds are usually sold. Also the ordinance bans the sale, barter or gift of living baby chicks, ducklings or other fowl "which have been dyed, colored or otherwise treated so as to impart to them an artificial color." There is a particular hot spot awaiting those who do that sort of thing, anyway. Congratulations to Chicago and to its humane organizations, which sponsored this regulation.



We like the decision of the California Department of Natural Resources with respect to the disposition of fishing equipment confiscated from violators of the fish and game laws. After rods and reels have been put into the best usable condition, they are turned over to the American Red Cross for the use of convalescing members of the armed forces. There has been a shortage of fishing tackle, which has grown as the war years have passed. Now the boys who have the best right to it can be cared for at the expense of those who have forfeited their right by law violation.

After the early winter flurry of picking All-American football teams and selecting baseball's most valuable players, the sporting world settles down for the proverbial hot stove league. It is then that the horticulturists put their heads together and pick their All-Americans. For 1945 they pinned a figurative silver medal on Flash Marigold and a bronze one on Real Gold Marigold, giving, we suppose, the real medals to their producers. In the Victory Garden department they handed out bronze medals to a pair of bush lima beans—Fordhook 242 and Early Market. A hybrid sweet corn and a couple of snap beans got honorable mention, but it was a great year for the Marigold and Bush Lima families. No gold medals were awarded, probably because the judges failed to visit our tomato patch.

Returning service men and women who have acquired animal pets abroad do not, for the most part, realize that a permit is necessary to bring a wild bird or mammal through a port of entry. This must be obtained from the office of the Fish and Wildlife Service, Merchandise Mart, Chicago, Illinois. The law requiring this—the Lacey Act—was passed in 1900 after the English sparrow and the English starling had gotten an immigrant's foothold here. It seeks to prevent the repetition of such invasions, and to protect wildlife throughout the world from exploitation for commercial purposes, as with feathers for women's hats. Monkeys, marmosets, agoutis, coatimundis, ant-eaters, kinkajous, honey bears, many members of the cat tribe and some birds may be brought in with little trouble, save the permit. The mongoose, and the flying fox or fruit bat, are not welcome. Parrots, which may carry parrot fever, are subject to quarantine. Some states prohibit them under any circumstances. Migratory birds of species native to the United States may not enter as pets. They come on their own power, and welcome. Among those for which the faunal immigration quota is closed are the skylark, European bullfinch, house mynah, Chinese mynah, European yellow hammer, greenfinch, chaffinch, black rat, brown rat, common house mouse, European rabbit and European hare. The hill or talking mynah of India is welcome. Parents, uncles, aunts, sisters, brothers and cousins of service men and women who have indicated they are planning to bring in some pet should warn them about the necessary permit. It is not a matter of "red tape" but just sane and proper protection of our native birds and mammals.

Because there are a lot of muskrats in Louisiana, and because a finicky populace still shies away from eating the excellent meat of this fur-bearer, the Louisiana Legislature voted that the name of the muskrat should henceforth be "marsh hare." We do not know how successful legislative ukase may be in changing eating habits, but muskrat *is* good.—R. W. W.

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Borders of the Bog

Photographs by the Author

By JOHN LINDSEY BLACKFORD

SKIRT the fringes of the forest, trace the winding, willow-bordered paths of streams in sinuous curves across the meadows, wander in aromatic sun and shade where sageland meets the pine hills, and there you will find the populous places of the wild. There, wildfolk communities meet and mingle, just as their divergent habitats narrowly merge together. Many other boundary lands claim this distinction of diversified growth and mingled population—riverbanks, timberline, foothill-and-prairie. Yet, among them all, none, I think, rivals the teeming borders of the bog.

For varied interest, for unending fascination, for sudden surprises and intriguing moments of discovery there is no other hunting ground like the margins of the marsh. Paddle along where head-high tules wade into deep water, invade back-water channels that wind away between waving cattail walls, inch forward upon quaking platforms of floating mosses, and you will seldom come back lacking adventure, although it be not always the kind you would have preferred.

One afternoon in June I sent the sharp bow of my boat in among tall reeds to explore the possibility of a bittern's nest. A suspected owner had stood unmoving with tawny, upstretched neck amidst shoreline tules while twice the outboard throbbed past within a dozen feet, its blue smoke drifting lazily about her. Undoubtedly she would have escaped detection among yellowing cattails; but the bulrushes were new green and offered poor pattern for her concealment. On my return, the keel slid up on a yielding hummock, and the boat glided to a soggy stop among clutching waterweeds. So I went overboard in the slime to follow the bird's first awkward flight to a nearby creek's mouth, where the stream sluggishly pushed its flow into the warm lake waters. Within a few paces of the muddy bank I collected a bootful of the greenish ooze as one unwary leg dropped an unexpected foot deeper into the miry morass. There followed a desperate moment of unbalance while the camera pack pitched forward from its shoulder hold and dipped precariously in the water. Then on by

". . . a perfect model, except when, between intervals of posing, he glimpsed opportunity to scuttle with startling alacrity into the sheltering reeds."

the creek the bittern left me, still slipping in the sucking mud, as she beat on powerful pinions far down the shore.

That is the frequent ending of many sallies along the borders of the bog. I crossed the stream, wading over boottop now, and beat the farther reaches of the marsh. Slogging back, farther out from shore, I paused again at the creek mouth disconsolately to survey the seemingly deserted cove. However, on what appeared an untenanted shore, other nerves grew taut. Abruptly an unseen mallard hen plunged from a cattail tangle beyond a nearby sunken log and skittered along beside the rushes into open water. "That's an old, worn-out trick," I almost told the bird aloud, as the "cripple" floundered away on the surface in pitiful flight, as if her back itself were broken. "But I'm keeping my eyes glued to where you must have a nest on the point."

So greatly was I absorbed in this suspicion that I covered the ground thoroughly, not looking up until the fruitless search was ended. Then, accusingly, I glanced after the fickle waterfowl. Surprisingly, she had turned back along the reedy marge and there, safely at fifty feet in open water, was making rendezvous with a tiny flotilla of downy ducklings!

At least the courageous old mallard had the right to believe that that ancient haven, the broad waters of the dark green lake, was safe refuge from terrestrial enemies. This clever strategy had won survival for her aquatic kind through countless years, until the manner of their escape had become an instinctive pattern, even in the behavior of those small, obedient balls of down now convoyed in her wake. In perfect silence they had put off from shore at a wide angle to her line of flight, and were already a fast vanishing meal for any gawking prowler left upon the bank.

But boat and motor were beyond the old duck's ken. Half way to the beckoning, mile-distant mazes of the farther reeds she lost the race. At once this mother mallard dived, surfacing beyond at more than a hundred feet—not a desertion of her babes but the offering of herself as target for renewed pursuit.

Unguided, faced with the bewildering bulk of the noisy craft, the eight ducklings proved elusive prey. The boat circled them, and yet, in breaking from the pivot of its whirling course, they uncovered amazing speed. Never once did they scatter. Cutting them off again from return to shore called for thrusting the outboard into high speed.

Once more in the center of its slower circling they were constantly beyond reach, and only a lucky grasp brought one beady-eyed paddler unwillingly aboard. Then I slowly followed the fuzzy fleet back to the cattail margin. Escorting her ducklings again, the devoted mallard showed how quickly she had learned an unexpected lesson. She marshaled the remaining seven and led them up the low shoreline into its dense, curving, willow border. Always the land had spelled danger for their web-footed tribe. Yet now she instantly turned to it to win safety for her brood, realizing, despite the strangeness of the event, that her own element had failed to provide a refuge.

Hastily I photographed my winsome, downy passenger—a perfect model, except when, between intervals of posing, he glimpsed opportunity to scuttle with startling alacrity into the sheltering reeds. Finally, carrying him carefully back to the little swamp, bounded by open gravel shores, I left him safely among covering lily pads where his keen-eyed parent would venture back into the bog.

Little life stories are enacted within the green, tangled depths of the swamp to which we seldom penetrate; but along its inner, water-bounded border the bog often discloses lesser secrets. On Island Lake in western Montana my boat drifted along the cattail screen dividing quivering sedge-mat from deep, amber-brown lake water. Suddenly the clattering of a female red-wing fairly assaulted me from the midst of the sword-like blades. Her fear and irate temper seemed unusual, and I put in beside the dense aquatic growth. Examining it minutely, I soon found her cradle—a pictorial disappointment. Only two eggs rested in the basket. One had been punctured, and its contents drained from the bluish shell. Yet in this disturbed state of affairs the blackbird's anxiety was

"Along this same cattail 'coast' a muskrat house interrupted the solid front of the green-leaved wall."

nonetheless notable. I marked the spot, and, recalling her concern, paused there next evening. She had not deserted the nest, although on neither occasion was the high, whistled *kee kee* of a mate heard, or his black-and-scarlet suit seen flashing as he hurried to defend it. She seemed unprecedentedly to carry this burden alone. Moreover, the broken egg had been removed, and a third sepia-marked treasure deposited in its place.

It would have been of interest to note the ultimate number of the cradle's contents, and the final result of her faithful nesting, could one have lingered to record it. Farther on I discovered another blackbird bassinet, woven of dried sedge grasses and deftly laced, two feet above the water, to stout cattail stems. In the gently swaying cup were hidden four olive ovals, curiously and beautifully scrawled with dots and pen lines of purplish-black.

Along this same cattail "coast" a muskrat house interrupted the solid front of the green-leaved wall. Its reflection shimmered and wavered picturesquely in oily ripples between crowding cattail stalks. Fresh root cuttings floated away from its littered base as though some fen dweller had been lunching there on my approach. Narrow, arched runways led away through saw-grass and sedge, inviting in their secret destinations. At dusk one could expect to see several furry heads dividing the dark waters, towing long tule stems perhaps, and converting the lodge into a center of marshland activity.

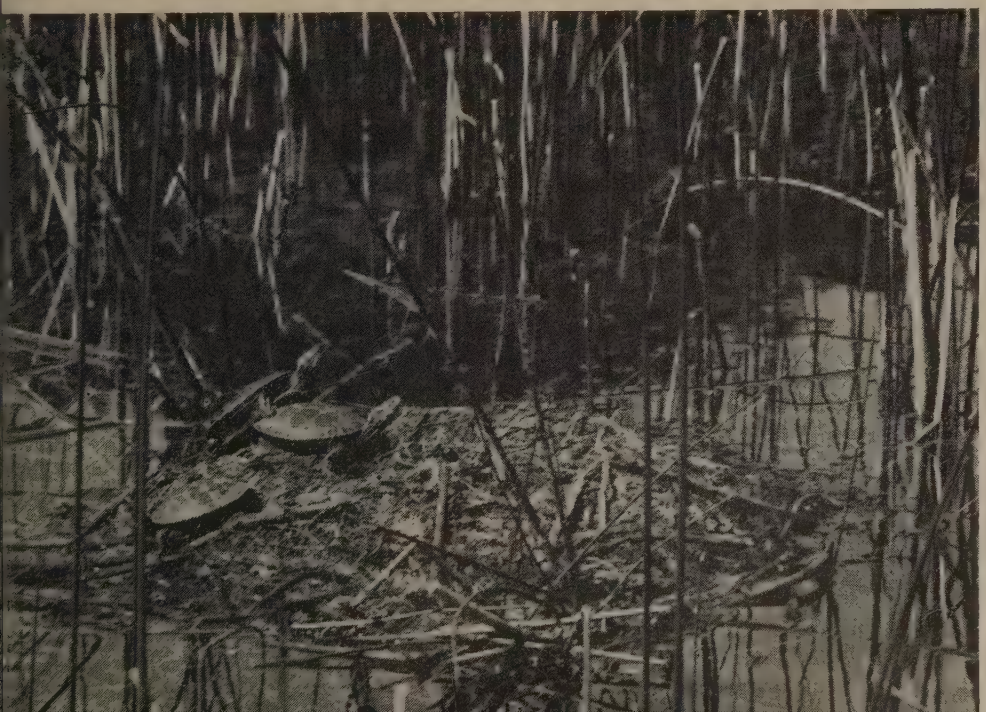
Now I heard the loud, quavering laugh of a loon, and, paddling slowly past its fir-crowned island, turned the boat toward the narrows of the lake. Gusts of wind helped drive the craft down the channel. Occasionally large raindrops spattered the dark, tossing surface. The loons, a pair with half-grown young, were met midway of the passage. Toward either side the cattail wall was only a hundred feet—too narrow for their liking. As the boat bore down to them, both youngsters and one of their guardians vanished, the older bird in a swift leaping plunge.

The male lifted himself high on the water, displaying gleaming white breast and flashing underwings; then, going about, he slowly led on through the narrows, voicing his wild cry at intervals. In a moment his mate rose beside him and joined to lure me into the farther waters. But, directing the boat toward the leeward rushes, I let it rock against the reedy margin. Intermittently, when the squall seemed to heighten and ragged scud tore overhead, the weird high wail of the great northern diver pierced the fitful, boisterous wind.

Watching closely for the appearance of the young loons, it became apparent that the strategy of the old birds was more subtle than that of lesser waterfowl. In a half-hour neither of the two gray-white young was glimpsed, while their parents returned slowly back upchannel, striving to attract attention. Once it appeared as though the female attempted to slip by silently, along the opposite, bending reeds, while her mate redoubled his eerie laughter. But, seeing the ruse observed, she sank quietly and rejoined her companion.

Quite evidently the little loons had made an immediate underwater escape, swimming unseen in the depths to one marsh-bound shore. There they had emerged in some hidden alleyway of the reeds, or risen unseen in the green tangle, and, like elusive water witches, waited motionless with only eyes and bill above the black water. No understory or high forest-crown canopies a swamp to offer endless and varied refuge; yet what other homeland of the wild can match the marsh in its numberless hideouts and havens? Where else does the art of concealment rival that deception practiced by wary dwellers of the bogs? The loons are of the wide lake waters; but before they attain to their unexcelled powers of diving, they too must be well schooled in the secrets of the adjoining fenways.

From a stony knoll, humped up amidst deep marsh and lush meadowland in the Kootenai country, one can sweep with glasses the scummy waters, the dead and greening tules, tall cattails and rank sedges of a spring-fed bog. One afternoon, dreamily scanning this watery realm, listening to the tinkling lay of a rollicking bobolink, I noticed the congregating of a



"Three pairs of sleepy reptilian eyes blinked slowly; three brave crewmen . . . together went over the side."

number of Brewer blackbirds. Their clamor reached across the sunny meadow; and their swirling flight as they dived and struck at some object moving in the high grasses claimed attention. They hung above the recipient of their wrath like a small black cloud, and with such persistency as to cause me reluctantly to desert the shade, forget the fine minstrelsy of Robert o' Lincoln, and restore a welcome peace to the flock.

It was a large, brilliantly-striped garter snake whose presence had aroused the hovering blackbirds. From a short distance I could observe them harrying the gaudy fellow; but he was fairly safe in the rank sedges, and appeared to be proceeding steadily toward a small slough. Beyond it several of the glossy black dandies paraded on an old rail fence and preened their iridescent plumage in the sun.

I routed the serpent and crossed the slough, to learn that the blackbirds viewed a photographer with even greater suspicion. Collecting in a mob above me, and rallying slate-brown mates from the grass, the colony elders shrieked their choicest epithets. Before I searched for them the nestfuls of ebony fledglings were no secrets; their location had been advertised beyond doubt.

"In the gently swaying cup were hidden four olive ovals, curiously and beautifully scrawled with dots and pen lines of purplish-black."

One nest, then another within twenty feet, held trios of feathered pickaninnies. Bright-eyed and mouse-quiet, they flattened themselves in quaint nest-cups sunk at the damp base of the sedges. Even under the stare of the camera the nestlings maintained an exemplary quiet—small dusky object lessons for their raucous, lemon-yellow-eyed parents overhead. There was nothing praiseworthy about the garter snake's intentions. Of this you were certain as you stole a last look at the junior blackbirds, and closed the coarse grass-tufts over their nodding heads. But even that scaly citizen can give you helpful hints along the borders of the bog.

Although I wanted a picture of the eggs one knew must be aboard the red-necked grebe's floating nest-raft, it was not for that reason it first interested me. It could be seen, resting low in the tepid water, anchored to tall thin canes near the pond's end. Both red-necks were patroling the little bay just beyond the reed line. If the four or five dirty-white eggs were there, the birds had covered them well with decaying vegetation; and incubation was proceeding as usual, one might surmise, as sun and decomposing water weeds supplied the little heat they required. That is, if the eggs were not well awash under their covering of soggy debris and the weight of a dozen or fifteen members of the "crew" who manned this precarious barge.

At least that many painted turtles, of miscellaneous sizes, had hauled out on the lone nest. Under their load and that of possibly five longish eggs hidden beneath them, the green tule stems, arranged to form a rude framework for the raft and to give it buoyancy, were deeply submerged. Yet the fact that the nest was close-crowded with contented turtles, basking undisturbed in the noonday sun, was proof enough that the owners considered their presence aboard no trespass, and were not worried over the eggs being sunk.

I put aside this excuse for my intrusion, and, little hoping for a picture of the crew, paddled slowly in toward their strange craft. One by one each "sailor" dropped reluctantly overboard. Only six were left. Putting down the paddle and lying flat upon the forward deck of the boat, I grasped the tule stems ahead, and pulled myself by inches farther into the swamp. Another and another of its reptilian occupants quit the raft. At eight feet, where the reeds parted to afford a clear view, I pressed the shutter. Three pairs of sleepy reptilian eyes blinked slowly; three brave crewmen considered deliberately, and together went over the side. There were eggs in the grebe nest. Soiled white shells of the "cargo" could be glimpsed "between decks" on the refloated raft.

Despite its slimy depths, its stagnant oozes, tormenting insects, and miry bottoms, there is more than adventure in the swamp. I sat hunched atop a beaver lodge one morning in warm rain that occasionally pelted giant lily pads and rippled weedy pools. Whirligig beetles spun dizzily in eccentric circles on the scummy water. Scintillant sapphire dragon flies shot like miniature bombers along the tule wall. A spotted sandpiper, vagrant from his clean beaches, tilted on a grass-tufted log. From bog birches and alders, adrip with rain-pearls, came a trim, brown-backed bird. The water wagtail tiptoed saucily among the sedge tussocks, flitted to the giant pads of pond lilies rising on stout stalks above the surface like great lotus leaves, and was lost in their (Continued on page 216)

Odd Bedfellows and the Wood Frog's Wedding

By WILFRID S. BRONSON
Illustrated by the Author

The author, comparing notes on wood frogs, climbs into bed along with Aristophanes and Thoreau.

For years, like many a Nature student, I have kept notebooks filled with detailed dated data. Recently I have been reading, for the first time, in the Nature notebooks of Thoreau. It is fun to compare his written thoughts on wood frogs, accumulating over several springs, with entries of my own.

In thus turning to the 19th Century, one is reminded of how much more the classics counted then in the thinking of an educated man than they do today. I had to turn much farther back, to 405 B.C., really to understand one reference of Thoreau's regarding frogs. And so, in studying *The Frogs* by Aristophanes, I gleaned yet another writer's thoughts about these animals, for even more comparing.

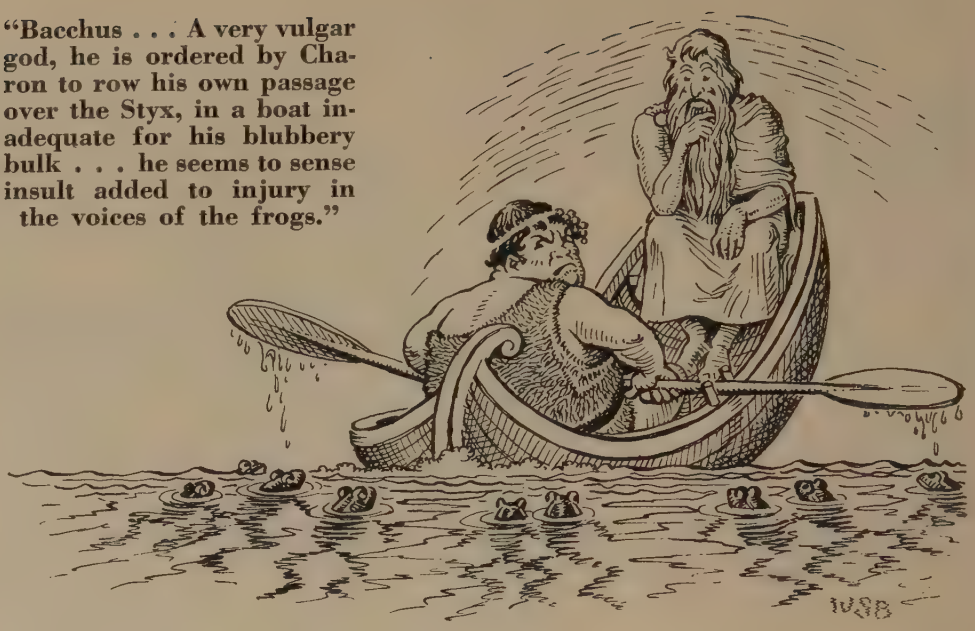
This comparison makes the oddest bedfellows of Aristophanes, Thoreau, and me, and it is drawn, not with any notion that my own crude scrivening has a place, as such, beside the work of the great Greek humorist and playwright, or beside unplayful, humorless Thoreau's, but only as one may compare the qualities of Pentelican marble, Plymouth Rock, and shale. Conditioned as each was by the age in which he wrote, uninfluenced by the others, what were our several reactions on observing frogs ?

Differences of course there are, but, in our recording of the voices of frogs at least, some striking similarities. Our efforts are often complementary. Sharp scientific accuracy, unimportant to the poet of old, is achieved by the 19th Century philosopher—up to a point. And where Thoreau's pen may have been halted by the proprieties of his time and place of writing, the quill of Aristophanes has been considered over-free in many a line, even in our day. But, less free than Aristophanes and less fastidious than Thoreau, I shall, in this 20th Century, attempt to tell not only of voices, but "more that can be told" concerning wood frogs in the spring.

Of course, Aristophanes never heard the flat, dry cackling of the American wood frog, *Rana sylvatica*, although some Mediterranean species may have an almost identical voice. Compared to the green frog's "Dunk, dunk, dunk," or the bull frog's "Rum, more rum," the wood frog's cry sounds very dry. So also did the frogs of ancient Athens, if we rely on Aristophanes, the English translator carefully preserving the sounds indicated by the Greek. Animal cries are difficult to describe or imitate in writing in any language. But note the surprising similarity between the imitation of frogs by Aristophanes, and a description of the wood frog's cry entered in my notebook several years ago. What I described on April 22, 1939, as a "rackety, rachety, cackle, or quack," Aristophanes gave as "Brekeke-keks, co-ak, co-ak" in 405 B.C. The fact that, in his play, the frogs were in the Styx, and therefore croaking in Hell, would not account for the notable dryness of their voices, for the pagan Hell of ancient Greece was far from being a region of fire and brimstone only.

Only in a play would a choir of frogs taunt and defy a noisy, violent human being, let alone a god. Yet as some of the verses show, Aristophanes knew a good deal of actual frogly habits. So is it not reasonable to believe that, in writing a chant for them in the play, he also gave, as best he could, an approximation of their actual cries in the refrain? Although capable of talking back to Bacchus, the frogs continually repeat their "Brekeke-keks, co-ak, co-ak," much to his annoyance. Briefly, at the point in the plot

where the frogs take a leading role, here is the situation. There is a temporary shortage of good poets in Greece, and Bacchus takes upon himself the task of going to Hell to bring one back to Athens. A very vulgar god, he is ordered by Charon to row his own passage over the Styx, in a boat inadequate for his blubbery bulk. Much discomforted by the unaccustomed exercise, he seems to sense insult added to injury in the voices of the frogs, and lashes out at them with tongue and oar.



"Bacchus . . . A very vulgar god, he is ordered by Charon to row his own passage over the Styx, in a boat inadequate for his blubbery bulk . . . he seems to sense insult added to injury in the voices of the frogs."

"Brekeke-keks, co-ak, co-ak."

Bac. "Oh, the Frogs, consume and rot 'em,
I've a blister on my bottom.
Hold your tongues, you tuneful creatures!

Frogs. Cease with your profane entreaties
All in vain forever striving:
Silence is against our natures.
With the vernal heat reviving,
Our aquatic crew repair
From their periodic sleep,
In the dark and chilly deep,
To the cheerful upper air.
Then we frolic here and there
All amidst the meadows fair;
Shady plants of asphodel,
Are the lodges where we dwell;
Chaunting in the leafy bowers
All the livelong summer hours,
Till the sudden gusty showers
Send us headlong, helter, skelter,
To the pool to seek for shelter;
Meagre, eager, leaping, lunging,
From the sedgy wharfage plunging
To the tranquil depth below,
There we muster all a-row;
Where, secure from toil and trouble,
With a tuneful hubble-bubble,
Our symphonious accents flow.
Brekeke-keks, co-ak, co-ak."

There is more, but this is plenty for the purpose of comparison. Thoreau was much impressed with the dryness of the wood frog's cry. Here are some of his notes on it, beginning with the one that sent me studying Greek comedy.

"March 15, 1860. Am surprised to hear from the pool behind Lee's Cliff the croaking of the wood frogs. . . . Their note is somewhat in harmony with the rustling of the now drier leaves. It is more like the note of the classical frog as described by Aristophanes.

"March 23, 1853. A remarkable note with which to greet the new year, as if one's teeth slid off with a grating sound in cracking a nut." An English walnut probably would give the best approximation.

Another time he tries to imitate the sound in writing, but succeeds mainly, I think, in demonstrating the difficulty of doing this. It would read more dryly had he written "wurak or wu-ak." But he writes:

"March 24, 1859. Now when the leaves get to be dry and rustle under your feet, the peculiar dry note wurrk wurrk wurrrk wurk, of the wood frog is heard. . . . A singular sound . . . associated with the first warmer days when you sit in some sheltered place in the woods amid dried leaves. . . .

"He pitches and tunes his voice to chord with the rustling leaves which the March wind has dried. . . .

". . . A single dry hard croak, like a grating twig, . . . such is the earliest voice of the liquid pools, hard and dry and grating."

Still considering this quacking dryness in wetness. let me quote a few notes of my own.

"April 22, 1939. The combined quacking of the males makes a mighty racket. Each one, sounding somehow impatient after a winter's inactivity, keeps croaking his rackety, ratchety, cackle, or quack; and all this vocalizing, accompanied by the instrumental music of two spring waterfalls, plus the crash of heavy ice pillars collapsing into the pond from the quarry walls, creates a deafening din. . . .

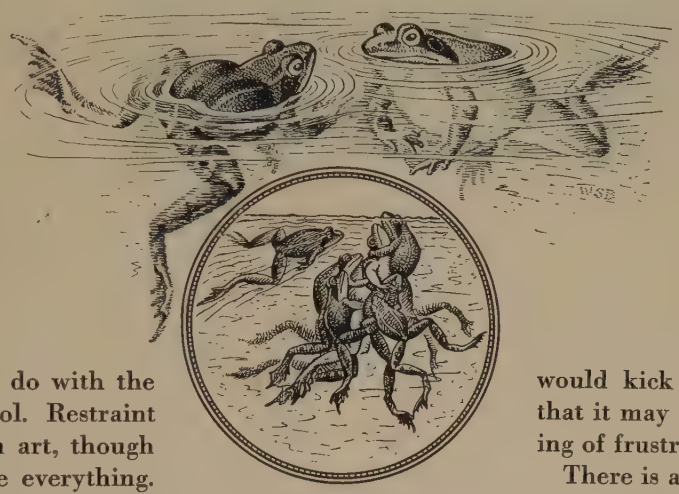
"April 13, 1938. I worked at the stone table in the sun. The frogs were very noisy, their voices sounding oddly dry, but with so many overtones and echoes in the quarry that half the time I was not sure that Sonia wasn't calling from the house below. . . .

"March 29, 1938. They utter another sound today as well as those described above. It is simply a very short flat 'Ach!', higher pitched and louder than the other sounds." "Described above" refers to:

"March 25, 1938. A secondary sound, amidst what sounds to me like a million poaching eggs, is a sort of moan-groan, like somebody suffering from toothache." The ache of the frogs, of course, is closer in character to the pangs of love. Perhaps the "poaching egg" idea is fairly apt, for every quack is accompanied by a sudden bloating of the frog's throat and sides, as though he were impersonating a steam-blown bubble, and certainly eggs is the big idea the frogs are cooking up.

Referring back to the secondary "moan-groan" sound, let me quote Thoreau once more:

"April 3, 1853. There is not only the incessant lively croaking of many together, as usually heard, but a lower, hoarser, squirming kind of croak, perhaps from the other sex." Here is the only instance in which he shows that he knows sex has anything to do with the noisy conclave in the pool. Restraint is important in life and in art, though in science one should state everything. The sounds Thoreau so painstakingly described were merely the music to a wood frog wedding he was watching, the extraordinary, interesting, even at times amusing details of which he must have witnessed as regularly as I. Possibly, himself so unrequited in his human need for love, he was too like the numerous superfluous bachelor frogs, too altogether unfamiliar with success in love, to discuss even in his private records this part of Nature's plan.



"There is always a long stag line at the Annual Wood Frogs' Wedding Ball, and much cutting in."

But the inexorable fact of the matter is that in every frog there is enough of an ego needing the individual satisfaction of success in matrimony so that the species as a whole is ensured a future. Eggs laid in the water do get fertilized by sperms likewise liberated, turnkeys unlocking cells to free the lives imprisoned there through embryonic growth to hatching time. Although males clasp females, it is nonetheless a hit-or-miss performance except that, in the case of wood frogs, Nature makes more sure by producing every spring a vast majority of males, something like six or twelve or even more, to every female. The resulting polyandry presents a spectacle to astonish, but a scene varying from year to year only as the spring is late or early, and in the ratio of females, males, and supernumeraries.

"April Fool's Day, 1938. Wood frogs so far have laid a square yard of very black eggs. As I guessed, males outnumber females five or six to one. Every female I saw (some had gone, having dropped their responsibility) was straw color with brown markings, the males all very dark and purplish.

"Two terrible scrimmages, in one at least a dozen males all trying to embrace one female. She sank amongst those who actually had grasped her, a blonde beauty with swarthy suitors. Her body was strained back and how she could live I cannot see.

"April 21, 1939. I thought I saw something singular in the plurality of male wood frogs last year and the resulting polyandry due to the scarcity of females. But this year five purple-brown males clung to one big light tan female. She couldn't kick her legs at all but floated in apparent contentment, propelled in circles and figure eights by the spasmodic kicks of her beaux, first one, then another, then several together. Then they'd come to a full stop until one or another, unable to get a good grip with so much competition, would kick out again, futilely, except that it may have eased a mounting feeling of frustration."

There is always a long stag line at the Annual Wood Frogs' Wedding Ball, and much cutting in. Are the females aware of, and do they enjoy this popularity at all, each truly a belle of the ball surrounded by eligible males and certain of becoming a bride at last in instantaneous duplicate? Each is a belle, not only of the grand ball itself but of her own particular ball of consorts revolving around her. Whether or not she realizes and relishes her personal glory, it is hazardous. "Safety in numbers" does not here apply. In the midst of the melee she may suffer accidental injury and she may die, her ribless body stabbed by the too tightly pressing thumbs of one or more competing males.

"April 26, 1944. I found a female wood frog dead in the water, her chest punctured and eggs slowly oozing from the injury.

"April 27, 1944. I found another dead female wood frog, not punctured but possibly hugged to death, and she also had not lived long enough to lay. Then I spied a female with six males and scooped her with three of the males into a scap net. Out on the bank two let go immediately but one held on for several minutes. I removed him and he transferred his strong instinctive grip to my finger. 'Love is blind' and thoughtless here. 'Frog he would a'wooing go' whether you would distract him or no, 'Ko-ak' says Rana."

It is said that Aristophanes wrote *The Frogs* to distract men's minds from public affairs. Perhaps susceptibility to distraction is proportionate to a man's or animal's intel- (Continued on page 218)

Flowers that Follow Fire

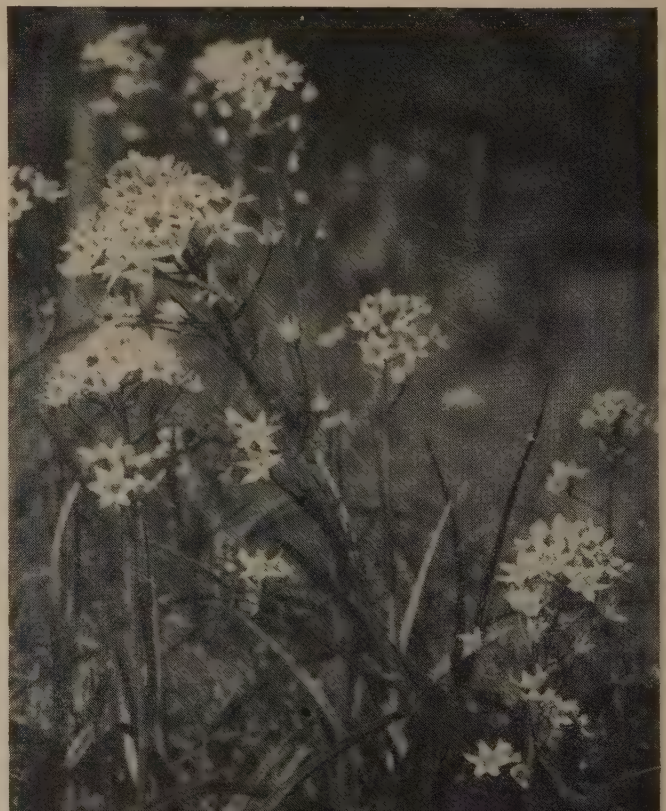
By LESTER ROWNTREE

IT WAS twenty years ago that my interest in the relation of wild flowers to fire became fully awakened. During a field trip in the southern Californian mountains I rounded a curve and saw, some five miles away, a north slope painted in the garish orange-red of a brilliant sunset. The display swept across the slope like low evenly-surfaced flames. Driving closer, I saw the charred trunks of trees rising out of this brilliant beauty. The following year, on a foothill road in central California, I came upon a broad sea of pale salmon, broken by the black of burned shrubbery. After these two demonstrations by California wild flowers, the first by tangerine-colored wind poppy, the second by its paler counterpart, the western poppy, I settled down in earnest to observe the aftermath of fire.

Fire has too long had its way with the trees and chaparral of the West. In spite of continued publicity, the resultant damage is not yet realized by the majority of people. But there is another side to fire-effect that, while it in no way lessens the original destruction, demonstrates Nature's methods of healing her wounds. The study of fire-following plant life has revolutionized man's reforestation and shown him easier ways. It is rare now to see forest tree seedlings, pampered under nursery conditions, hand-planted on waterless slopes where their shortened root systems cannot carry them through the dry summer. A more obvious course is followed, that of broadcasting seed into the ashes and letting the seedlings send their long tap roots deep into the ground for moisture, encouraging them from the first to be on their own and to cope with conditions they are quite capable of meeting.

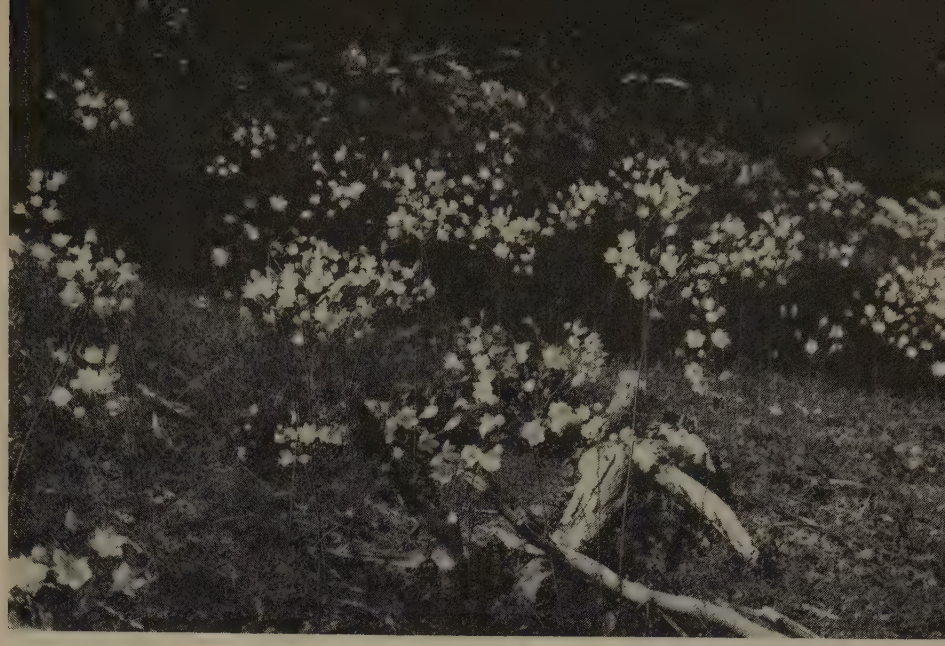
The longer the field worker watches the behavior of fire-followers the stronger becomes the realization that Nature knows her job. The inflow of native growth after fire is no peculiar caprice; it follows a well-defined pattern. By looking at well-conditioned forest or chaparral one can tell fairly accurately what would follow if a burn were to occur, and in what order. One comes to know which trees and shrubs root-sprout after fire, and which are killed outright. One can generally tell which seeds are in a hurry to hide the ashes, and which ones take their time. In spite of this proud assurance, there is always the fascination of an unknown quantity, for down in the earth below every dense stand of growth there may be seeds of plants that have remained latent for years, biding their time for the right sprouting conditions. These conditions are often offered by fire when it burns away other vegetation and releases the dormant seeds.

There is a refractory group of western wild flowers,



A burn seems to give special encouragement to the blooms of the lily, *Zygadenus fremontii*, which puts forth prodigious blooms when it springs up in an area over which the flames of a forest fire have swept.

On the facing page is the fragrant, tangerine-colored wind poppy with its maroon center, a fire-follower that covers fire-devastated acres with its startling bloom. At the right is one of the Brodiaeas, *B. laxa*, or Ithuriel's spear, growing from a bulb and encouraged by a reasonable scorching afforded by a chaparral fire. Photographs by the Author.



the germination of which for long has been a thorn in the flesh of the garden or nursery propagator. It took forest and chaparral fires to suggest the covering of flats with straw and then setting fire to them. This usually does the trick and induces seeds to grow in a few weeks—seeds which, by old methods, took years to sprout. Among these obstinate ones are some of the loveliest native California shrubs. The yellow tree poppy, *Dendromecon rigida*, leaps into germination when burned over, and, in compatible places in the wild, one year's growth produces healthy little shrubs bearing multitudes of over-sized flowers. Seeds of Matilija poppy, *Romneya coulteri*, have, in the flat, always been stubborn until burned. This is a self-willed shrub in many respects, doing either not at all or too well, refusing to grow under the tenderest treatment and yet coming up through concrete cracks where it is not wanted, and taking over territory so completely that it is impossible to dislodge.

But fire pleases it and soon brings action to the tiny, recalcitrant seeds.

Propagators have always run into difficulties when trying to raise *Nama parryi*, and two dutchman's breeches, from seed, but these three tall perennials appear like magic in the wake of brush fires. At a distance *Nama parryi* looks something like a tall, exceedingly healthy penstemon with flowers, the purple-blue shade common to many beard-tongues being carried thickly along the eighteen inches of the coarse, eight-foot stems. This conspicuous plant follows the canyons of the central and southern California Sierra, stopping when it gets to an altitude of 7000 feet, and is particularly striking after fire, although always disheveled looking at close range. The two dicentras are more dignified and very decorative. Both have attractive fern-like foliage and wide upstanding habit. The bloom of yellow-flowered *D. chrysantha*, golden eardrop, comes along the upper half of its branched six-foot stems, and *D. ochroleuca* bears rounder clusters of pale straw-yellow flowers perched atop four-foot stalks feathered with pretty gray foliage. These three perennials are not among California's best known wild flowers, for they grow in out-of-the-way places, and the only time they appear in overwhelming quantities is after fire has passed their way. Then seedlings spring up by the thousand, and new shoots on old plants that have been surface-burned become heavily blossom-laden.

Both the lemon-yellow-flowered *Fremontia californica*, so common in the mountains of southern California, and golden-flowered *F. mexicana*, the species usually grown in gardens, rejoice after fire. In one blackened place I measured a nine-foot, one-year's growth of *F. californica*, heavily blooming and with foliage of such profusion and healthy vigor that,

Slopes that were once clothed with chaparral, then fire-swept, may soon bristle with blooms of *Brodiaea capitata*. Each bulb will send up several blooms as soon as the rain comes to inspire its rapid growth.

This hillside was a blackened waste after a fire not many years ago. Now *Yucca whipplei* has sent up its tall and striking spikes as Nature attempts to heal the wounds of the flames.

if it had not been for the flowers, it would have been difficult to recognize the bush. Prickly poppy, *Argemone platyceras*, is one of the plants whose seeds can wait until harmonious conditions come its way. There are Californian valleys and canyon flats that have not seen a prickly poppy plant for twenty years, but which, after a visitation by fire, break out with two-foot branches of gray-green capped by huge, snowy flowers, centered with yellow stamens. Although prickly poppy is usually an annual I have seen it, after fire, become perennial, and, in one year, produce from the old root six feet of new growth, topped by flowers almost equalling those of Matilija poppy in size.

Most of the plant growth responding to fire appears the first year. California native shrubs, and many wild perennials and annuals, have long tap roots, and, unless the conflagration has lasted long in one place, these deep roots are still intact. Fire softens the hard, bony shells of seeds, fertilizer is created by burned material, top soil has been pulverized by fire action, competition has, for the time, been removed, and there are light, air and openness. Thus encouraged, seeds and roots spring into vigorous performance with the first rains. If these rains are heavy downpours, erosion sets in and this surface layer is washed away. The unprotected topsoil moves off with its load of seeds and roots, leaving the subsoil exposed and bereft of humus. But if gentle rains come first, germinating seeds and inciting beheaded roots to bestir themselves, the soil soon becomes a network of busy advancing threads. These succeed in saving the day and quickly bring to the scene that extraordinary after-fire display of bloom.

A good scorching delights bulb seeds, and these, together with certain annuals, perennials and root-sprouting shrubs, are among the first green things to show above the dismal gray-black expanse. Indians used, and still use, bulbs for food. Knowing the effect of fire on their supply of provender, they periodically burned sections of the land in order to increase the yield. The shiny, rich-green, exuberant-looking seed-leaves of brodiaeas shoot up as though obsessed. Slopes previously clothed in chaparral bristle with *B. capitata.* Land that outskirts forests is pierced with *B. laxa* and *B. volubilis,* the twining *Brodiaea,* robbed of its natural support, must twist itself round the stalks of its brothers. Bulbs of lilies and erythroniums (adder's tongue) that have been long under fire die, but a casual burning cleans off grubs and possible diseases. Bushy hillsides, on which *Zygadenus fremontii* have been burned, produce prodigious bloom, and mariposa lilies are strengthened by fire, sending up stems of amazing length and flowers of exceptional size and brilliancy. Fire-lily is one of the names given to squaw-grass, *Xerophyllum tenax,* because, although these plants of the lily family usually take several years out between blooming periods, after fire moves over their tuber-like rootstocks the dry grassy ridges on which they grow become concealed by cream-white throngs of massive flower racemes. Farther south another member of the lily family, *Yucca whipplei,* redeems fire-swept territory by sending up much taller and more

Matilija poppy and squaw grass, or fire-lily, are both followers of fire.

pointed spires than the fire-lily. These are heavy with waxy, creamy flower-bells.

Fire gladdens many of the phacelias. Old timers living near the Santa Rosa mountains still hark back to the spring some thirty years ago when whole mountain sides were purple with *P. parryi. Phacelia viscida,* a handsome bright-blue species, is a stunning sight after fire, when it covers acres and acres of coastal land, and *P. brachyloba,* a yellow-centered, white or lavender species of this large fire-following genus, appears after fire on mountain slopes where old inhabitants have never seen it before. Yellow *Mimulus brevipes,* wild wallflowers, and all the wild snapdragons relish a bit of fire. Climbing *Nemophila aurita* loves it, and whispering bells, *Emmenanthe penduliflora,* is another annual that needs a blaze to help it do its best. This relative of the phacelias has nodding flowers of pale yellow, which rub against one another, making a sound like the low wind. The two annual poppies, the wind poppy, *Papaver heterophyllum,* and the western poppy, *Papaver californicum,* are among California's choicest wild flowers. for they are delicate enough to have great charm as well as beauty. The deep maroon center in the fragrant wind poppy shades off to scarlet at the edge, and is still further enhanced by maroon stamens capped with yellow anthers. The flower is two inches across, and the eighteen-inch stems decked with pinnately-cleft leaves of soft gray-green are slender enough to sway delightfully in the breeze.

Two eager fire-followers are distributed through states and countries where fire is not the menace it is in our West. Perennial fire weed, *Epilobium angustifolium,* does quite well without fire, but better still if it gets a good blaze. Since it lives in moist soil it may go for many years without a burn. I have seen this eight-foot cosmopolitan flourishing in many states and countries, but never so riotously happy as on an island off the coast of Maine where it surmounted an entire fire site, reaching up above the dead branches and smothering the entire island in bright fuchsia-purple. It lives in Canada from Labrador to Bering Sea as far north as trees grow, and sometimes beyond, and south to North Carolina, Kansas, Arizona and northern California. In Canada it occupies thousands of square miles, following fires. It grows also in northern Eurasia.

The other international fire-fancier, the European biennial foxglove, *Digitalis purpurea,* has naturalized itself along the northern California coast up into Oregon, where it follows the logging fires. Its chance comes before the Port Orford cedar and the Douglas fir seedlings take over and become so dense that they absorb the room and light, chasing the foxglove out until the next logging. In England, where fires are few, foxglove seed lies dormant for generations, and when a stump is burned this flower may spring up where no foxglove has grown within the memory of man, even local botanists. (Continued on page 216)

Pioneers in Conservation:

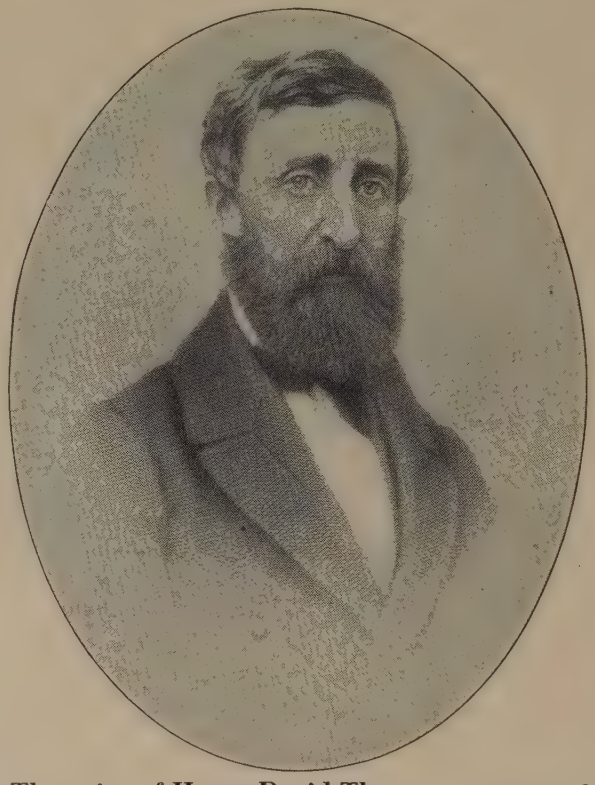
Footnote to the History of an Idea

By PAUL H. OEHSER

TRACING the origin of an idea is at best an elusive quest, since it seems to be true that there is no such thing as pure originality. Nonetheless, it is sometimes a profitable quest, for to discover that some newly hatched idea is "as old as the hills" somehow restores one's humility. Take, for example, the idea of conservation, which we are in the habit of thinking of as relatively recent, dating roughly, perhaps, from the reign of Theodore Roosevelt the Elder, who gave conservation ideas a forward spurt.

Some notion of the antiquity of this idea and its attendant problems may be had from old Izaak Walton himself, who puts the following words into the mouth of his Piscator during the third day of the Compleat Angler's contemplative discourse:

"He that shall view the wise Statutes made in the 13th of Edward the First, and the like in Richard the Second, may see several provisions made against the destruction of fish: and though I profess no knowledge of the law, yet I am sure the regulation of these defects might be easily mended. But I remember that a wise friend of mine did usually say, 'that which is everybody's business is nobody's business': if it were otherwise, there could not be so many nets and fish, that under the statute size, sold daily amongst us; and of which the conservators of the waters should be ashamed."



The voice of Henry David Thoreau was one of the first to be raised in behalf of conservation.

King Edward "Longshanks" reigned from 1272 to 1307 and Richard II from 1377 to 1399, but conservation antedated these early English rulers by many centuries. Again it is Izaak Walton who points this out. "But, above all," he says, "the taking of fish in spawning-time may be said to be against nature: it is like taking the dam when she hatches her young, a sin so against nature, that Almighty God hath in the Levitical law made a law against it." The law he refers to is found in the Fifth Book of Moses, called Deuteronomy (22: 6, 7), and reads as follows: "If a bird's nest chance to be before thee in any tree, or on the ground, whether they be young ones, or eggs, and the dam sitting upon the young, or upon the eggs, thou shalt not take the dam with the young: But thou shalt in any wise let the dam go, and take the young to thee; that it may be well with thee, and that thou mayest prolong thy days." Semitic scholars date the Book of Deuteronomy as having been compiled during the seventh century, B.C.

Although the early colonists to America brought the conservation idea with them—in England there had been game keepers and conservators of rivers, sewers, and forests—they naturally saw little need for its application to the abundant natural resources of the New World. By 1700, however, at least half a dozen noteworthy conservation measures had been adopted in the colonies. I take these from Richard Lieber's conservation chronology found in his book, *America's Natural Wealth:*

1626. Plymouth Colony regulated the sale of lumber outside the colony.

1677. Connecticut prohibited exportation of game or of hides and skins.

1681. William Penn's Fundamental Ordinance stipulated that in clearing land one acre in five should be left for trees.

1687. New Hampshire enacted a law regulating mackerel fishing.

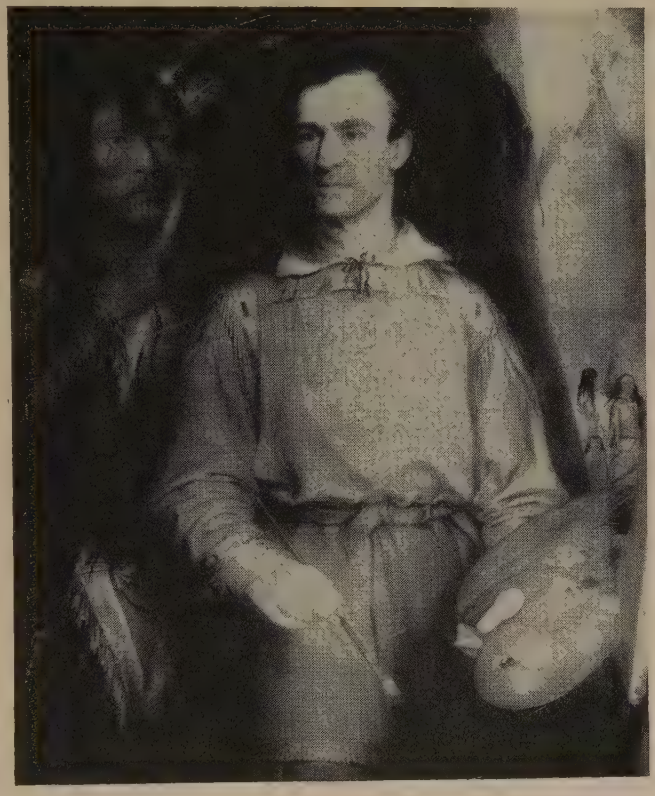
1691. Virginia required licenses for hunting in areas remote from settled districts.

1693. Massachusetts set a closed season for deer.

The eighteenth century saw many additions to this list, regulating the killing of wild animals, the parceling out of the public domain, and other restrictions, but no conspicuous contribution to the conservation idea came until about 1832. In that year George Catlin, the famous painter of Indians, was a passenger on the *Yellowstone*, the first steamer to go up the Missouri to the mouth of the Yellowstone River. He

was out to paint the Indians, or, as he put it, to produce "a literal and graphic delineation of the living manners, customs, and character of an interesting race of people, who are rapidly passing away from the face of the earth." He was greatly impressed with the beauty, vastness, and richness of the country he traversed on this 3-months journey up the river, and the thought of its despoliation brought to him the idea that a large tract of land in the region ought to be preserved as a national park. But let us read his own impassioned utterance:

"And what a splendid contemplation too, when one (who has travelled these realms, and can duly appreciate them) imagines them as they *might* in future be seen, (by some great protecting policy of government) preserved in their pristine beauty and wildness, in a *magnificent park*, where the world could see for ages to come, the native Indian in his classic attire, galloping his wild horse, with sinewy bow, and shield and lance, amid the fleeting herds of elks and buffaloes. What a beautiful and thrilling specimen for America to preserve and hold up to the view of her refined citizens and the world, in future ages! A *nation's Park*, containing man and beast, in all the wild and freshness of their nature's beauty! I would ask no other monument to my memory, nor any other enrolment of my name amongst the famous dead, than the reputation of having been the founder of such an institution."



George Catlin, painter of Indians, envisioned a great national park preserving natural beauty and wildlife.

Catlin's 2-volume work, *Letters and Notes on the Manners, Customs, and Condition of the North American Indians*, describing and depicting his "eight years' travel amongst the wildest tribes of Indians in North America," including the historic trip up the Missouri, was published in London in 1841. Yellowstone National Park was established by Act of Congress in 1872—the first of the present extensive system of national parks and monuments. George Catlin died on December 22, 1872. Although his original suggestion pertained particularly to the Great Plains country, and although he never explored within the boundaries of the present Yellowstone Park, credit for the national-park idea would seem to be his.

Catlin was also one of the first to call attention to the dangers confronting the buffalo herds and to the wantonness with which they were being exploited. "It is truly," he says, "a melancholy contemplation for the traveller in this country, to anticipate the period which is not far distant, when the last of these noble animals, at the hands of white and red men, will fall victims to their cruel and improvident rapacity; leaving these beautiful green fields, a vast and idle waste, unstocked and unpeopled for ages to come, until the bones of the one and the traditions of the other will have vanished, and left scarce an intelligible trace behind." In 1832, when these observations were made, this was no less than courageous prophecy.

Another man who, a hundred years ago, had many eloquent things to say on the subject of conservation was Henry D. Thoreau, of Concord. Thoreau was a poet-philosopher who enjoyed his little hermit's hut at Walden Pond not too far from the luminous atmosphere of Cambridge. But he also had a feeling for the primeval. Between 1846 and 1857, a few years after his memorable week on the Concord and Merrimac with his brother, he made three trips to the backwoods of Maine, by railroad and steamboat and Indian guide. An account of these journeys is contained in his book *The Maine Woods*, and a recent reading of these essays, together with abundant evidence in his other writings, convinces me that perhaps Thoreau was America's first real conservationist. This remarkable book, which now has passed through many editions and printings, is a paean to the American wilderness, an eloquent prayer for its preservation, anathema to its despoilers of whatever variety.

In the essay called "Chesuncook" Thoreau tells of a moose hunt that one of his party engaged in. He makes it clear that hunting was not what he went into the woods for. "I think," he says, "that I could spend a year in the woods, fishing and hunting, just enough to sustain myself, with satisfaction. This would be next to living like a philosopher on the fruits of the earth which you had raised, which also attracts me. But this hunting of the moose merely for the satisfaction of killing him, not even for the sake of his hide, without making any extraordinary

exertion or running any risk yourself, is too much like going out by night to some wood-side pasture and shooting your neighbor's horses. . . . This afternoon's experience suggested to me how base or coarse are the motives which commonly carry men into the wilderness. . . . Every creature is better alive than dead, men and moose and pine-trees, and he who understands it aright will rather preserve its life than destroy it."

It would be hard to find such strong and straight conservation talk as this in the work of Thoreau's contemporaries or forerunners. Even Audubon, with all his love and knowledge of the American wilderness, exhibited little conservation sentiment, and could relate, for example, the wanton slaughter of 144,000 golden plovers without batting an eyelash. Thoreau, however, perhaps because he was a poet, viewed the wilderness with an extraordinary breadth of vision. He knew that America was still new, much of it then unexplored and unmapped; there was still "the virgin forest of the New World." But he could read the signs. He was fearful that "Maine, perhaps, will soon be where Massachusetts is." He was fearful for the unbroken pine forest that then covered the "greater part of New Brunswick, the northern half of Maine, and adjacent parts of Canada, not to mention the northeastern part of New York and other tracts farther off." He knew what the sawmills meant to these forests.

Along with George Catlin, Thoreau was one of the first to suggest the establishment of a wilderness area as we think of it today, for this is how he concludes "Chesuncock," the second part of *The Maine Woods:*

"The kings of England formerly had their forests 'to hold the king's game,' for sport or food, sometimes destroying villages to create or extend them; and I think that they were impelled by a true instinct. Why should not we, who have renounced the king's authority, have our national preserves, where no villages need be destroyed, in which the bear and panther, and some even of the hunter race, may still exist, and not be 'civilized off the face of the earth,'—our forests, not to hold the king's game merely, but to hold and preserve the king himself also, the lord of creation,—not for idle sport or food, but for inspiration and our true recreation? or shall we, like villains, grub them all up, poaching on our own national domains?" That was first published in 1858.

What influence such expression had on the conservation movement in America is difficult to say, for "influence" is a rather nebulous thing. But it must have had many readers, and some of the seed must have fallen on fertile ground. The trouble was that a few voices, although eloquent, could scarcely be heard above the tumult of expansion, commercial development, land hunger, and gold rushes that the country was undergoing. Small wonder that the conservation idea took so long to jell in America. But we may be thankful that the few voices were there, to lend impetus, when the time came, to a movement which, although slow and halting, finally became a crusade as important as any in the history of our country. It was a crusade of life and death—for the life of America's natural resources, for the death of private interest and greed and wantonness. And the end of this all important fight is not yet in sight.

★

Valedictory

By RAYMOND TIFFT FULLER

Too many years I felt the stars
Stared down in searing mockery;
Now savants of the skies reveal
That even stars are kin to me;
That suns are massive molecules;
A mote of dust a cosmos proves.
I cannot doubt my inmost pulse
Is linked to all that shines or moves.

Now midnight galaxies seem close;
My brain's electrons vibrate back.
"—Hail, brothers, soon we too will whirl
On Vega's or Arcturus' track!" . . .
Always must they speed in space;
God's restless rhythm cannot wait;
And never does a wave-length die
Or find a rendezvous with fate.

If honor to my ashes fall,
What higher than be cast upon
Such pyres as I see flaming there
In Deneb and Aldebaran?
. . . Why did Creation ever hit
On *me,* and deign to dower
With such a tick of Destiny
And such a tock of Power!

Why Not the Sparrows?

By ANNE FARIES-SMITH

★

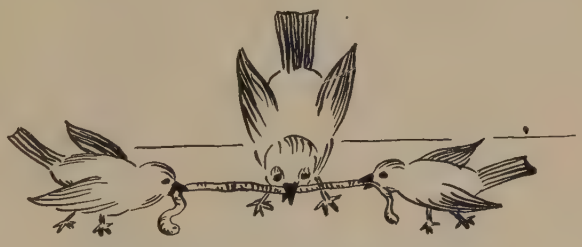
"The window sills of my third-floor apartment are brushed clear of heavy snow, popular lunch counters for months at a time."

ARE you one of those persons who persist in asking, "Why save the sparrows?" Do you think of these little gray, brown birds as quarrelsome, noisy and dirty? Do you feel they should be exterminated? I have heard their right to live questioned many times, yet I ask, "Why *not* the Sparrows?"

These little immigrants never asked to be transported to our country, where they are looked down upon, and where, like so many of God's children, they must face prejudice added to storms. And, by the way, they are not *true* sparrows but members of the weaver-bird family, highly developed in Africa, Malaysia and Australia.

What if the sparrows have not confined themselves to the meat diet of undesirable insects, which their importers insisted they absorb? They have eaten many of these, but they also enjoy meatless days—when fruit and vegetables fill the bill.

The sparrows are referred to as grasping and quarrelsome. How can they help being grasping when all they have with which to lay hold of their food is a tiny bill, and so they must hang on tight. They do grasp soft, dark bread and poke it down their little ones' throats. They take water and give them sips to make them learn to dip in for themselves. Often one takes his piece of bread (and it's sometimes quite sizable) to the garage roof to eat in peace. Alas, he is usually followed by at least one friend, and they take alternate bites. I have been surprised that there is so little fighting among them. They do at times fly up at a robin, when, after watching him dig up a worm or bug, they pounce on it. One morning a robin pulled an angle worm out from the lawn. A watchful sparrow grabbed one end. The robin held on to his dignity and the middle of the worm and then, for an instant, a second sparrow caught the worm's far end—and there was *one* worm that did not turn.



The robin held to his dignity and the sparrows to the ends of the worm.

I spoke of the storms the sparrows face; the wintry weather they endure with courage. Minna Irving wrote

"He's cheerful in weather so bitterly cold
It freezes your bones to the marrow;
I'll admit he's a beggar, a gangster, a bum,
But I'll take off my hat to the sparrow."

Early one spring, in one of our tornadic Minnesota storms, when even large birds were blown off their nests, a woman gathered into her dish pan several scores of sparrows, chilled and nearly drowned. She put the pan on the floor near the kitchen stove. The next morning her kitchen was alive with chatter and flutter. She opened the door and away they went—all but one. He stayed quietly above the door for a few hours, then, with a few gracious "peeps," he made a polite departure.

Who says the sparrow has no playful ways? One little summer scene I do not forget. Half a dozen dusty sparrows had an empty ice cream cone, and each one nipped off what he could. The cone suddenly righted itself and stood erect like an Indian tepee before the astonished birds, who could not bite the smooth wall. For an instant they paused—and maybe shrugged their wings—before giving up in disgust.

When we have an "old fashioned Minnesota winter" the snow is deep. The window sills of my third-floor apartment are brushed clear of heavy snow, popular lunch counters for months at a time. On the ledges of the two adjacent windows of my den, I have counted fifty sparrows eating at a time, while clinging to the brick walls hung paratroopers looking for standing room on the buffets. When, on some rare occasions, the corn meal was spread, not a bird appeared. No wonder, for sabotaging the grain was a Nazi squirrel, wearing a luxurious fur coat and caring nothing for the "little peoples." Like the Gideonites of old I made a loud "bang-bang" (only I used pie tins), and down the wall went the squirrel.

The sparrow's response to friendly treatment has been beyond my expectation. I do not refer so much to my callers in Cairo, Egypt—for I had but two

weeks to make their acquaintance—but to the Minnesota settlers. Each morning in Cairo I sat in my bedroom in the pension and a breakfast tray was brought me. At the same time, from the window on a narrow court, came little English sparrows. They arrived as promptly as though they carried little Bulova watches under their wings. Military training was indicated, for at times two sparrows, keeping abreast, would hop across the floor and perch on the rungs of my chair. My pieces of bread were more to their liking than to mine, so I could afford to be generous.

The cone up-ended, its smooth sides defying the birds' bills.

My Minnesota sparrows know me, and come to meet me. I have formed friendships with them so that I always have a convoy between my back door and the street car. Several times when I have left the street car, half a block away, a group of sparrows, picking near the sidewalk, would rise and fly ahead of me, pause in the bushes as I passed, then fly on ahead and into the yard near the back door I would have to enter. I rarely go out of the door, that one or more do not fly toward me and drop down quite near. They appear from trees across the street, so swiftly that I marvel at their telescopic vision. In one little tree near the back door more than thirty birds often roost swaying in the breeze as they await my morning breadcast.

As we long for the welfare of God's children and creatures all over the world, we feel "our incompleteness" and turn to "His greatness." One winter's day, when it was 30 degrees below zero, I watched a little sparrow trying to get from his icy tree to my window sill, and breakfast. His toes were too nearly frozen to grasp the tiny twigs, and I watched him through misty eyes as he fell from one branch to another until he spread his tiny wings and made it to the window ledge. Was I alone in my little prayer for him? No, for I could rejoice that not one sparrow falls but what our Father cares. Call it sentimentalism if you will, but the Bible tells us so.

★

Hip! for the Rose Hip

By MAUD MACDONALD HUTCHESON

"GATHER ye rose buds" runs the old refrain, but it is rose hips that the British people have been gathering these war years. The fruit of the wild rose—the scarlet berry left when the petals fall—has been found to be amazingly rich in Vitamin C, and hundreds of tons are now being made yearly into syrup, jam and puree.

Credit for the important discovery really belongs to certain birds. Their keen liking for rose hips made British scientists ask why, and analysis yielded up the vitamin secret.

The Ministry of Food has done much to make the nation rose-hip conscious, and by radio and through the press housewives have been instructed how to prepare them for home use. With citrus fruit almost impossible to get, rose hip marmalade has substituted ably on the breakfast table. It is simply made—two pounds of rose hips, 1 tablespoonful of rosewater, 1 pint of water, and sugar. Boil the hips until tender, pour them through a sieve, then add a like quantity of sugar and the rose water. Boil the whole until clear and test on a plate. If the mixture "sets," it is done.

Britain's druggists have taken a keen interest in the discovery from the start. In the spring of 1942 they marketed 600,000 bottles of rose hip syrup and the supply has continued to increase. In some districts where there are local collection points industrial canners have arranged to buy the crop. Country folk are putting down for winter a rose hip puree, which is said to have a flavor akin to tomato.

The prominence that has suddenly come to this fruit of the rose is more of a re-discovery than a new find. Women in olden times, unconscious as they were of Vitamin C, made sauces, "sirops" and conserves of the berries. Ancient cook books contain recipes for rose hip tarts. They were richly seasoned with cinnamon and ginger, and thus made a most tasty pastry.

Pacific Coast Shells

The thirty-fourth in Nature Magazine's series of educational inserts.

By E. LAURENCE PALMER

THE tenth of this series of educational inserts (June-July, 1940), presented pictures and descriptions of fifty-two shells common along the Atlantic and Gulf coasts of the United States. It was suggested that a subsequent unit would consider similar organisms to be found on the Pacific Coast. The eighth unit in the series (February, 1940) gave more detailed accounts of a few shells of great economic importance, some of which are to be found on both coasts. To avoid unnecessary duplication, we are assuming that these earlier inserts will be available for use.

When these units appeared we were living in a safer period. Now many of us are widely scattered, and some may be isolated on Pacific strands, dependent on what the shore affords. Thus the mollusks are important. A few are poisonous, or even capable of biting.

In Europe, they say a sack of periwinkles is a standard picnic equipment. Of course, no mollusk is safe to eat if it has lived in polluted waters. Even oysters are dangerous if exposed to sewage, and especially if dead, and a single bad oyster in a stew may sicken a large number of persons. In general it is safer to eat a two-shelled mollusk than a one-shelled animal. Authorities generally seem agreed that the cone shells and the drills (*Terebra*) should be avoided. These are abundant in the Philippines, and some are reported to have a poisonous bite. For the most part, however, the shells found by the average amateur naturalist along our coasts are perfectly harmless.

It has been repeatedly demonstrated that the study of shells has value in restoring shell-shocked minds to normal. This alone should testify to the desirability of studying shells in these days of stress, whether at home or abroad. Many in the armed forces are making collections of shells. It would be well to encourage shell collecting by these men, and by those in training. Probably, as time goes on, interest in shells will not decrease. It is unfortunate that there is so little popular literature to guide the activities of amateurs. Obviously shells and shell collecting hold an appeal for all classes.

If you have a file of back numbers of *Nature Magazine* you may supplement the material given here, and in the previous inserts, by referring to a number of instructive articles. Important among these are the following: November, 1928, pp. 297-300; March, 1929, pp. 165-166; July, 1933, pp. 13-16; July, 1934, pp. 23-26, and November, 1938, pp. 541-544. Of these, the second reference, on the goeduck, should be "required reading" since an account of this delectable clam cannot be included here. The Pacific oyster, many mussels, barnacles and others must also be omitted.

A number of useful references are available to those wishing to study the subject more fully. Important are the following:

West Coast Shells, by Josiah Keep, revised by Joshua L. Baily, Jr., Stanford University Press, Stanford University, California. 1935.

Seashore Animals of the Pacific Coast, by Myrtle Elizabeth Johnson and Harry James Snook, The Macmillan Company, New York City. 1935.

The Marine Shells of the West Coast of North America, in four parts, by Ida Shepard Oldroyd, Stanford University Publications. Geological Sciences. Stanford University, California. 1924.

Marine Shells of Puget Sound and Vicinity, by Ida Shepard Oldroyd, Puget Sound Biological Station of the University of Washington, University of Washington Press, Seattle, Washington. 1924.

Molluscan Fauna from San Francisco Bay, by E. L. Packard, University of California Press, Berkeley, California. 1918.

The Edible Clams, Mussels and Scallops of California, by Frank W. Weymouth. Fish Bulletin, Number 4, State of California Fish and Game Commission, Sacramento, California. 1920.

The Life History and Growth of the Pismo Clam, by Frank W. Weymouth. Fish Bulletin, Number 7, State of California Fish and Game Commission, Sacramento, California. 1923.

Illustrated Key to West North American Pelecypod Genera, by A. Myra Keen and Don L. Frizzell. Stanford University Press, Stanford University, California. 1939.

Summary of the Marine Shellbearing Mollusks of the Northwest Coast of America, from San Diego, California to the Polar Sea Mostly Contained in the Collection of the United States National Museum, with Illustrations of Hitherto Unfigured Species, by William Healey Dall. Bulletin 112, Smithsonian Institution, United States National Museum, Washington, D. C. 1921.

Pacific Coast Shells, by Katherine V. Palmer. Slingerland-Comstock Company, Ithaca, New York. 1925.

Survival on Land and Sea, by Ethnographic Board and Staff of the Smithsonian Institution, Publications Branch, Office of Naval Intelligence, United States Navy. Washington, D. C. 1944.

The illustrations here are by Dr. Katherine V. Palmer, and credit is gratefully given her for counsel and guidance.

The Pelecypods or Bivalves

(Plates 1 and 2, pages 194 and 195)

FAMILY PECTINIDAE. The scallops of the Atlantic Coast were discussed in detail in the eighth and tenth educational inserts. *Pecten irradians,* the commercial scallop of the East, was figured in both of these inserts, and its detailed life history was presented in the eighth. These well-known shells are common subjects of art and appear freely in commercial advertisements. The notch under the ear of the shells marks the opening through which an attaching byssus may be spun.

(1) Pink Scallop. *Pecten hericius.* Length: 1 to 2½ inches. A conspicuously pink shell, with unequal ears, thin, with the ribs bearing slender spines. The under valve is white, while the upper one is pink-banded and with fewer ribs. It is a deep water species more common to the north but found from Port Althorp, Alaska, south to San Diego, California. Off San Juan Island, Washington, it is found at depths of 150 to 200 feet.

(2) Pacific Scallop. *Pecten circularis aesquisulcatus.* Length: to 3 inches. Typical form, with shell more bulging than in the variety, so that the variety is sometimes called Equally-grooved Scallop, while the typical form is called the Round Scallop. The shell is found in deep water, or at shoreline at low tide, lying on the right side, or attempting to escape. While the whole soft part of the animal is edible, commercial shellers extract the "meats," or adductor muscle, for sale, and reject the darker parts. It ranges from Santa Barbara to Cape San Lucas in Lower California, and is dredged commercially at Anaheim, California.

(3) Purple-hinged Scallop. Rock Scallop. *Hinnites giganteus.* Length: to 6 inches. Height: to 4 inches. Diameter: to nearly 2 inches. When young, it is free swimming, with the shells nearly alike, but with age it becomes attached to a rock by one shell, which becomes modified to conform to the rock. The shell near the hinge inside is alway a deep purple. When disturbed, an adult may clap its shells together, forcing a stream of water several feet into the air. It is not abundant enough to be of commercial importance, nor is it easily taken. It ranges from the Aleutian Islands to Magdalena Bay in Lower California.

FAMILY ANOMIIDAE. The Plain Jingle Shell of the Atlantic, *Anomia simplex,* member of this family, discussed in insert 10.

(4) Rock Oyster. Jingle Shell. Pearly Monia. *Anomia machrochisma.* Length: to 4 inches. Attached to rocks or to other shells, one shell being much smaller than the other and bearing a hole through which a muscle scar is visible. It is rough outside, but a beautiful pearly cast inside, with purple and green tints. The flesh is bright orange and is edible, although it is not considered to be commercially important. It ranges from the Pribilof Islands and the southern Bering Sea area to Japan and the Sea of Okhotsk on the West, and to the East along the whole coast to Lower California. At Puget Sound, it is found at depths of 100 to 250 feet.

FAMILY MYTILIDAE. Edible Mussel. *Mytilus edulis.* This is identical with the Atlantic Coast species, discussed in insert 8.

(5) Straight Horse-Mussel. *Modiolus rectus.* Length: to 4 inches. This mussel, unlike some other Pacific Coast species, has shells brown rather than black, and the "umbo" is not at the extreme end. The shells are also either conspicuously ridged or bearded. This mussel is usually solitary, partly buried in mud or gravel, and attached. It is edible but not commercially important. Ranges Bolinas Bay, California, to Magdalena Bay, Lower California.

(6) Pea-Pod Shell. Hooked Pea-pod Shell. *Adula falcata.* Length: to 3 inches. Shell: thin and flexible being pearly white inside and dark chestnut outside with a series of conspicuous transverse wrinkles. The animal can and does bore holes in solid rock and then attaches itself with a strong byssus. It is more common in sheltered shallow water than on exposed wave-beaten rocks. It ranges from Coos Bay in Oregon to San Diego, California.

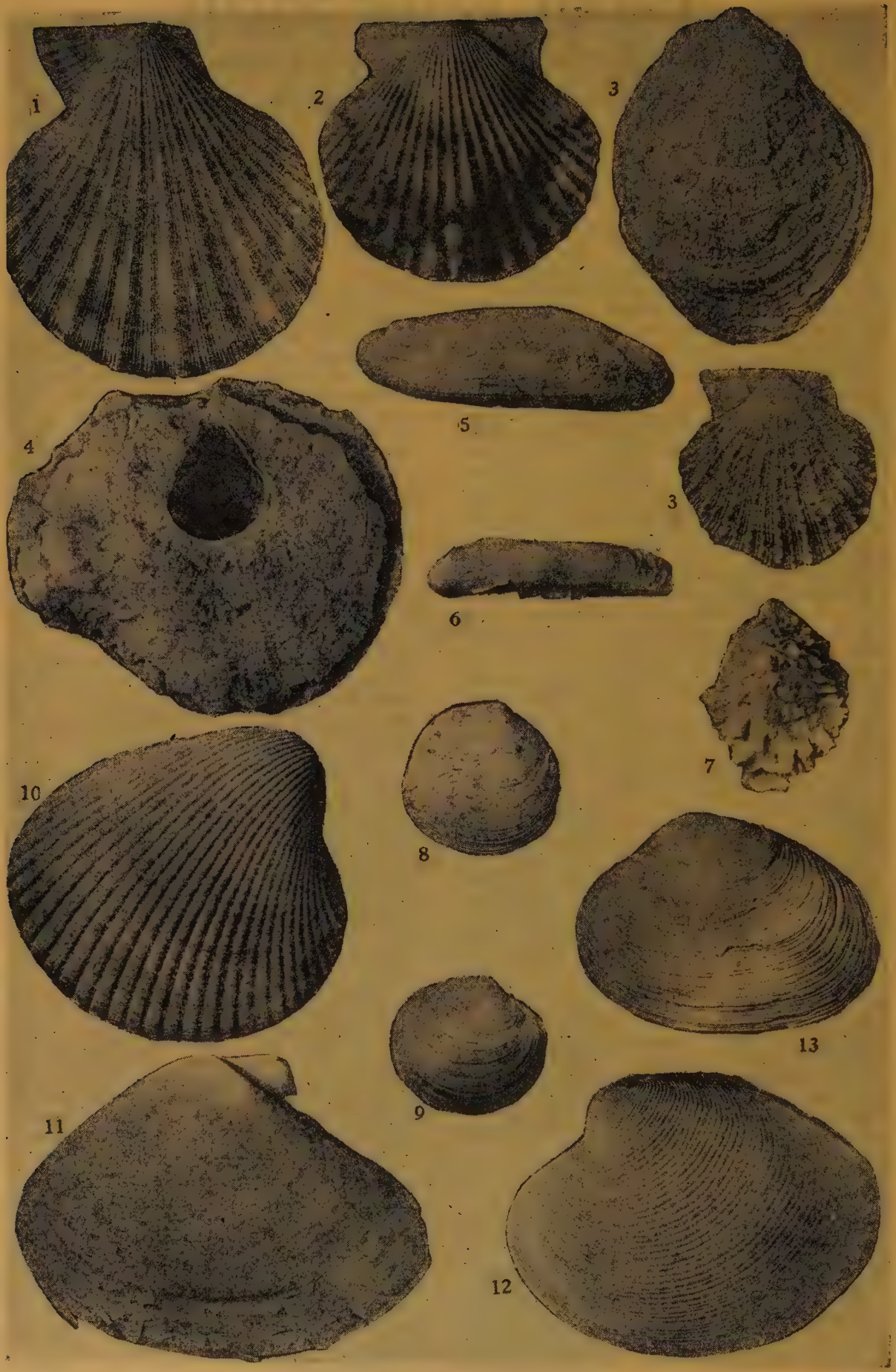


Plate No. 1

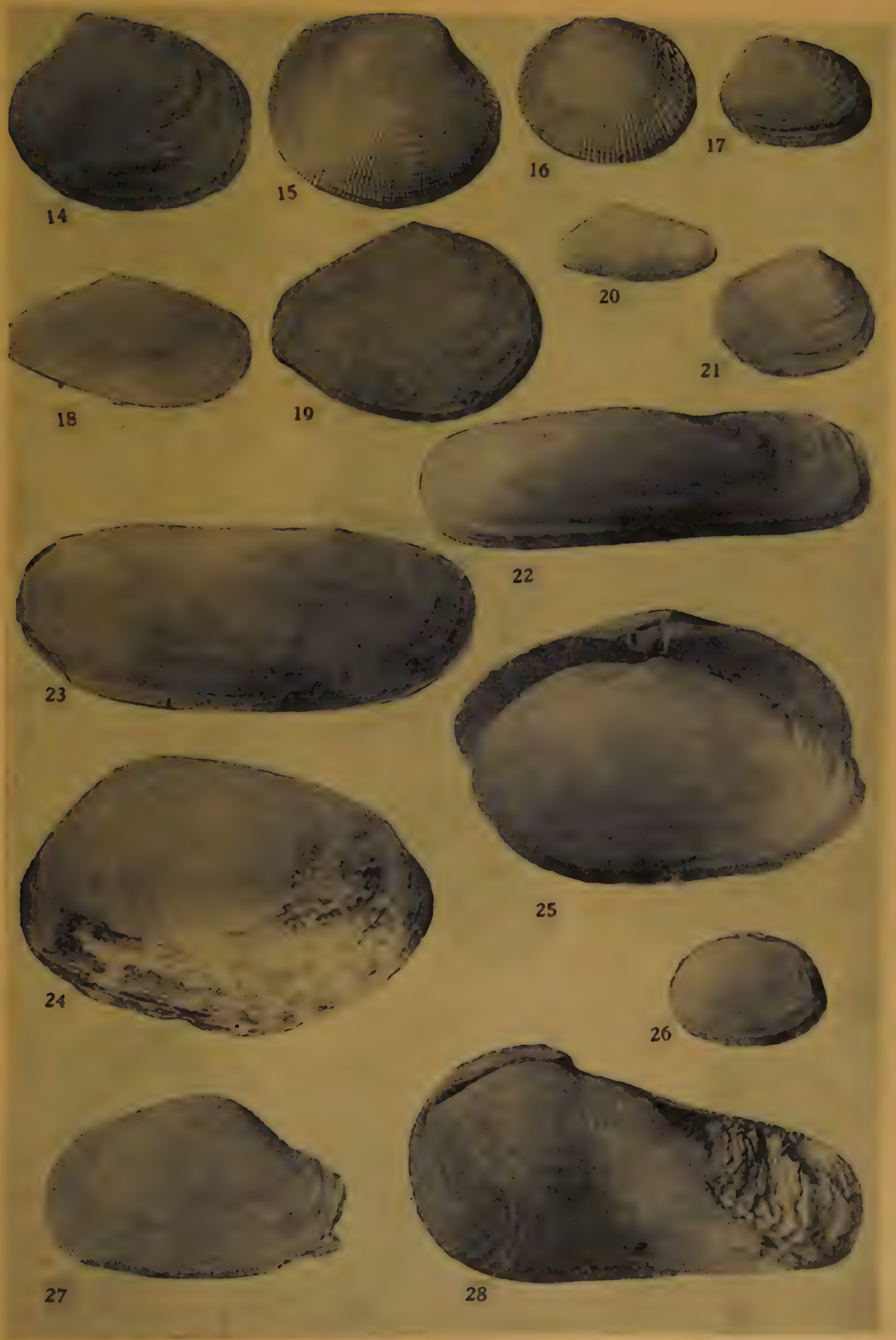


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Plate No. 3

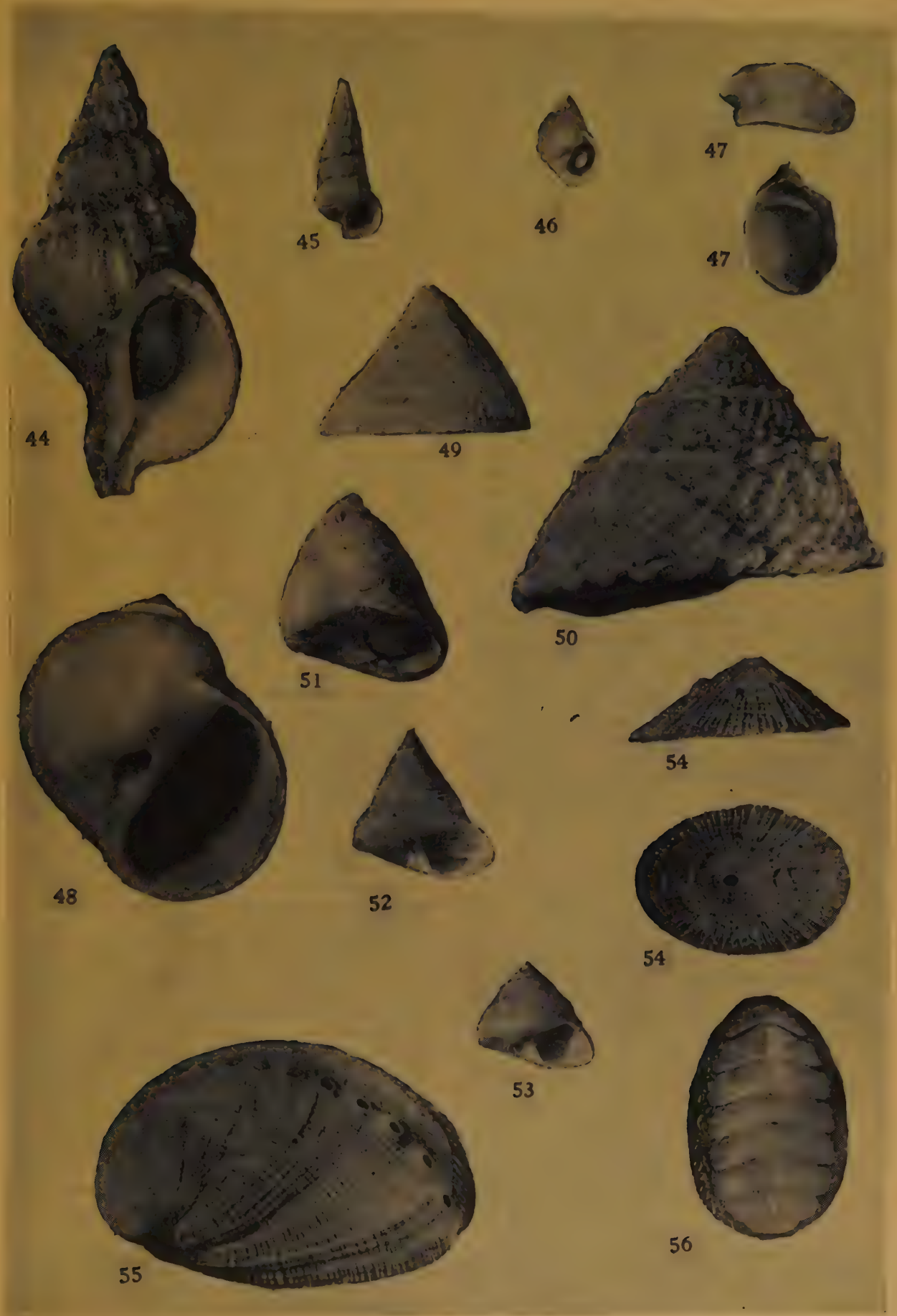

Plate No. 4

FAMILY CHAMIDAE. (7) Agate Chama. Rock Oyster. *Chama pellucida.* Length: to 2 inches. Outside of shell: irregular and rough or frilled and very hard, translucent, white or rosy or otherwise, with the inside lined with an opaque white layer frilled at the margins. Living shells are always so firmly attached that they may be removed only with difficulty, if the shell is to remain unbroken, and look superficially like nubbins on the rock, or like limpets. The young were considered as a separate species for some time. They are found from Oregon to Chile and the Galapagos Islands; commonest on pilings and breakwater rocks. (Chamidae.)

(8) California Lucina. *Phacoides californica.* Length: to a little more than an inch, almost round, white. Found in gravel or coarse sand or washed up on a beach. One of the common shells of the central California Coast. Ranges from Crescent City, California to San Ignacio Lagoon, Lower California. (Lucinidae.)

(9) Round Diplodon. *Diplodonta orbella.* Length: to nearly an inch. Height: about ¾ inch. Diameter: about ½ inch. Shells: smooth, white, marble-like and when alive commonly hidden in the sand with the sand cemented with mucus to form a nest from which the animal can extend its siphons through tubular openings. It is found from the Pribilof Islands and Bering Sea south to the Gulf of California. It is not uncommon in California, and was originally described from San Diego. (Diplodontidae.)

FAMILY CARDIIDAE. Morton's Cockle *Laevicardium mortoni,* of this family was described in the tenth insert.

(10) Basket Cockle. Heart Shell. *Clinocardium nuttallii* (*Cardium corbis*). Length: to 4 inches. Shell: brittle and easily broken, conspicuously grooved on the outside and white inside. It is active and makes a shallow burrow with the help of the long strong foot. It has no long siphon tube such as are common with the deep burrowers. It is edible, but in the southern part of its range is not sufficiently abundant to be commercially valuable. It ranges from Bering Sea to Japan and to San Diego, and is found on tide flats. According to some authorities it is the commonest species on the West Coast. California marketed more than seven tons in 1921.

FAMILY VENERIDAE. Six species in this family have been described in the eighth and tenth inserts. The most important species in the East is the Quahog or Clam, *Venus mercenaria.*

(11) Pismo Clam. *Tivela stultorum.* Length: to 7 inches. Weight: to 4 pounds 3 ounces. It is not legal to harvest Pismo clams of less than 4¾ inches. These weigh about 1 1/3 pounds. Shell: pale brown, often with faint, concentric, purplish markings. The shell appears to be varnished. The foot is short and like a plough-share. It spawns from July to September and the young are free-swimming a short time. It takes from 7 to 11 years for a Pismo clam to reach the legal size of 4¾ inches. Individuals have been known to live 25 years. This clam is found only on open surf-beaten sandy beaches, almost invariably above low-water mark. It ranks second only to the abalone in weight of the crop harvested yearly in California, but is rivalled by the introduced soft-shelled clam. Range, Half Moon Bay, California, to Socorro Island, Mexico.

(12) White Amiantis. Sea Cockle. *Amiantis callosa.* Length: to about 4 inches. Pure white. Thin at the edges. No ribs but many often paired, concentric ridges. Less triangular than the Pismo clam. Found on open beaches at extremely low tide but never in sufficient abundance to be commercially valuable. Ranges from Santa Monica, California, to Gulf of Tehuantepec.

(13) Nuttall's Saxidomus. Butter Clam. Money Shell. *Saxodomus nuttallii.* Length: to 5 inches. Shells usually marked with rough, eccentric ridges; when young, with brown markings on the beaks and with a trace of purple inside. These are about the most delicious clams the writer has ever eaten, but they are ordinarily too small for use commercially. The name Money Shell refers to their former use as money by certain Indian tribes. They are found in sand and gravel between tide marks. This species ranges from Humboldt Bay to San Diego, and a close relative, the Giant Saxodrome, or Washington Clam, is found from the Aleutian Islands to Monterey Bay. Sometimes in the markets of the Northwest.

(14) Thin Copper Shell. *Marcia subdiaphana.* Length: to 2 inches. Shell: thin, white, glistening and apparently swollen. Ranges, Sannak Island, Alaska, to Santa Barbara Islands, Calif.

(15) *Paphia staminea laciniata.* This variety of the species discussed above ranges from Unalaska, Alaska, to San Diego, California. It is distinguished from the other varieties by the possession of radiating ribs crossed by concentric ribs of equal prominence. At the crossing of ribs and rays there may be small spines.

(16) Ribbed Rock Venus. Hard-shelled Clam. Little-neck Clam. *Paphia staminea.* Length: rarely over 3 inches. With deeply arched valves so that it appears round. It is longer than the true cockle. The foot is flattened, and although strong, is not long. It is found in bays or gravel but not in deep mud. It is of some, although not great, commercial importance. It ranges from Commander and Aleutian Islands to Kamchatka and Japan; to Puget Sound and south to Socorro Island. There are several varieties of this species, of which one is figured as Number 15.

(17) Heart-shaped Rock Dweller. *Petricola carditoides.* Length: to 2 inches. Dingy white, oval, with radiating ribs but variable from long and narrow to flat and oval. Bores into soft rock and the shell conforms to the shape of the hole. It is also found on sandy and muddy beaches. Ranges from Vancouver Island to Magdalena Bay in Lower California. (Petricolidae.)

(18) Tellen Shell. Bodega Tellen. *Tellina bodegensis.* Length: to 2 inches. Shell: creamy white, with a polished surface, etched with fine, concentric lines. Found on outer sandy beaches where it is a strong, active clam. It ranges from Queen Charlotte Islands off British Columbia to the Gulf of California, and, while it is edible, is not abundant enough to be important. (Tellinidae.)

(19) Bent-nosed Macoma. *Macoma nasuta.* Length: to 2½ inches. Whitish, although often brown, stained with mud. Shells are light and thin-edged and the siphons are long, indicating a relatively deep burrowing habit. It is found in mud in sheltered bays, although it may be found also on sandy beaches. It can exist in stale, brackish water unsuitable for some other species. This shell has been found commonly in Indian "midden heaps," indicating its general use as food. These clams have found a market with the Chinese in San Francisco. The animal ranges from Kodiak Island and Cook's Inlet in Alaska to Scammon Lagoon in Lower California.

(20) Wedge Shell. *Donax californica.* Length: less than an inch. An attractive shell, thin and light, with related Gould's Wedge Shell often attractively colored. Lives just under the surface of the sand and ranges from San Pedro, California, to Panama. Formerly, large numbers of *Donax* were used for soups. (Donacidae.)

(21) Spotted False Wedge Shell. *Heterodonax bimaculata.* Length: about an inch but usually under. Shell: thin, flat, oval, with fine eccentric lines and white or purple. Ranges from Monterey, California, to Panama, and is also found on the Atlantic Coast. (Psammobiidae.)

(22) California Razor Clam. Jack-knife Clam. *Tagelus californianus.* Length: to 4 inches or more. Shell: thin, gray, dull, living in a vertical burrow in soft, sandy mud. It is a food favored by ducks, is edible for humans, although too small to be commercially important. It is sold in some places for use as bait. It is found from Santa Barbara, south to the Gulf of Tehuantepec.

(23) Flat Razor Shell. Sea Clam. Razor Shell. *Siliqua patula.* Length: to 6 inches. Shell: thin and brittle, smooth inside and out. White outside, zoned with violet, or inside tinted either with violet or with pink. The animal is not wholly included in the shell. The animal can move rapidly through the sand, and can completely bury itself within 6 or 7 seconds. When disturbed, it may squirt water high in the air. It is delicious and a favorite where it is sufficiently abundant in the south to warrant harvesting commercially. It is canned in Alaska and in Washington. It is usually found on the outer beaches from the Sea of Okhotsk to the southern border of Bering Sea, and south through Cook's Inlet in Alaska, and in related forms on south to Monterey. (Solenidae.)

FAMILY MACTRIDAE. Two species were described in the tenth insert. Another important one follows.

(24) Washington Clam. Summer Clam. Otter Shell. *Schizothaerus nuttallii.* Length: to 8 inches. Weight: to 4 pounds. Shell: thin and easily broken and not including all of the animal. Foot is small but the siphons are long and stout. The shell may lie buried from 1 to 3 feet deep in the bottom, usually below mid-tide. The clams squirt water high in the air when disturbed, sometimes to a height of 3 feet. While the siphons are tough, the flesh is delicious. Indians formerly dried the siphons for use later in soups and chowders. Found from Wrangell in Alaska to San Diego, California. The name goeduck is applied sometimes to this species but the term is the Indian name for *Panopea generosa,* Family Saxicavidae. See *Nature Magazine,* March, 1929.

(25) Sand Clam. Soft-shelled Clam. *Mya arenaria.* This species, introduced from the Atlantic with seed oysters, has established itself from Victoria, British Columbia, to Monterey, California. It is described in the tenth insert. (Myacidae.)

(26) California Soft-shelled Clam. *Cryptomya californica.* Length: to about an inch. Shell: white, thin, almost smooth, slightly gaping and sometimes ashy in appearance. It ranges from Chichagoff Island, Alaska, to Topolobampo, Mexico. (Myacidae.)

(27) Checked Soft-shelled Clam. *Platydon cancellatus.* Length: to 3 inches. White, gray or ashy, with greatly bulged valves. Surface marked by fine, irregular growth lines overlain with a brownish-gray cover. It is found in or near bay entrances where the current is brisk and where it burrows in firm, hard clay, not in rock or in shifting sands or mud. While it is edible, it is not found in quantities of commercial importance. It ranges from Bolinas Bay, California to San Diego, California. (Myacidae.)

FAMILY PHOLADIDAE. The Angel Wing Shell and the Little Piddock of the Atlantic Coast were members of this family described in the tenth insert.

(28) California Piddock. *Parapholas californica.* Length: to 5 inches. Upper end of the shell displays scales. Shells are white and delicate. The animal burrows in mud and in hard clay, and uses the waste material to build a stout, cone-like channel above it to protect the siphons, which reach up to the open water. The animal is edible but not of commercial importance. It ranges from southern Oregon to San Diego, California.

Class Scaphopoda

(Plate 3, Number 29, Page 196)

FAMILY DENTALIIDAE. The Tusk Shells. These shells and their animal inhabitants suggest relationships both with the pelecypods and with the gastropods. Like the former, they lack a true head and are bilaterally symmetric; like the latter, they have a single shell. They belong to a group midway between these two, called the Scaphopoda.

(29) Tooth Shell. Tusk Shell. Precious Tusk-shell. *Dentalium pretiosum.* Shells resemble small, slightly curved, hollow, delicate, white teeth or tusks, an inch or more long, with the larger open end being the lower, from which the animal extends the foot that is useful in digging in the sand. From the smaller, upper end, the animal extends the tentacles to capture the minute animals that constitute its food. I have a necklace made by Indians of the Northwest in which tooth shells alternate attractively with circular discs cut from other shells. Both of these shell materials were recognized as having money value by the Indians. The animals live mostly in the sand. They were collected by comb-like dredges. From Forrester Island, Alaska, to San Diego, California.

The Gastropods or Univalves

(Plates 3 and 4, Numbers 30 to 55, Pages 196 and 197)

To the twenty-seven gastropods discussed in the Atlantic Coast unit, we here add twenty-six from the Pacific Coast.

(30) Bubble Shell. Gould's Bubble Shell *Bullaria gouldiana.* Length: to 2 inches. Like a thin, polished, mottled brown or white, slate, or yellowish egg shell, and almost as delicate, with the spire, to be expected at the top, instead apparently pushed inward. Lives in and on mud flats from Santa Barbara, California, to Mexico. (Bullaridae.)

FAMILY OLIVIDAE. The Olive Shell described for the Atlantic Coast belongs to the genus *Oliva,* the members of which do not have an operculum with which to close the opening at the mouth of the shell. In *Olivella* of the Pacific Coast, the animal does possess a protective operculum.

(31) Rice Shell. Purple Olive Shell. Little Olive. *Olivella biplicata.* Length: about 1 inch. About the size and shape of an olive pit but smooth. Polished and beautifully and finely marked. White to dark slate colored, usually with purple markings. Live for the most part just under the surface of the sand, through which the animal can plow, leaving the siphon free to extend upward to above the sand. Ranges from Vancouver Island to Magdalena Bay, Lower California. The shells were considered sufficiently rare and interesting to the Indians to be used as money, or as ornaments.

FAMILY BUCCINIDAE. Of the more than two-dozen shells that can be considered as being relatively common on the West Coast and belonging to this family we can consider but one. Many of these are limited to the colder waters of the Alaska region.

(32) Tabled Whelk. *Chrysodomus tabulatus.* Length: to 4 or 5 inches. Diameter: to 2 inches. A coarse but beautiful shell, yellowish-white and with the whorls flat-topped and making a spiral table that is responsible for the common name. Outer lip is thin and smooth, while the inner is hard crusted. Lives in water from 150 to 1200 feet deep and is widely distributed, ranging from British Columbia south to San Diego, California.

(33) Columbian Amphissa (also called Wrinkled Amphissa). *Amphissa columbiana.* Length: to nearly an inch, the average being about ¾ inch. Light yellowish-brown and closely related to the Joseph's-coat Amphissa, which is only about 1/3 its length but highly variable in color. Columbian Amphissa is found in the mud where the sea is a hundred feet deep, more or less. It ranges from Chiachi Islands, Alaska, to San Pedro, California, and is abundant off Catalina Island. (Columbellidae.)

FAMILY NASSARIIDAE. Two Atlantic Coast Dog Whelks were discussed in the unit on Atlantic Coast shells.

(34) Tile-roof Dog Whelk. *Alectrion* [*Nassarius*] *tegula.* Length: to ¾ inch. With a stout, strong, evenly-tapering, pointed spire and a relatively small opening. Dark gray, with rather conspicuous bumps forming interrupted ridges from one end to the other. It is essentially an animal of the mud flats, and is found from San Francisco to San Diego, California.

(35) Channeled Dog Whelk. *Alectrion* [*Nassarius*] *fossatus.* Length: to 1¼ inch. Diameter: to ¾ inch. In older animals, the lip is much thickened in its outer areas. General color of the shell is pale, ash-gray but the enamel showing at the lip is bright orange. There are 7 whorls in a mature shell, these being marked by conspicuously spiralling ridges crossed by more coarse and obscure, longitudinal ridges. A long breathing tube extends into clear water above the mud while the animal forages rather actively for food relatively deeply in the mud. It ranges from Vancouver Island, south to Cerros Island off Lower California.

(36) Frieze-covered Dove Shell. Eel-grass Shell. *Columbella gausapata.* Length: to less than ½ inch. Shell described as about the size of a grain of wheat, chestnut-brown, polished, glistening and marked with spots or stripes or dots. The spire is conical and the lip is thickened. The animal lives at the roots of eel-grass in enormous numbers, and the dead shells may be most abundant on the shore. It ranges from Port Etches, Alaska, to San Diego, Calif.

FAMILY MURICIDAE. The Borer and Oyster Drill shells found on the Atlantic Coast were members of this family that were discussed in the tenth insert.

(37) Festive Rock-shell. *Murex festivus.* Length: to 3 inches, or more. Shell is elaborately ornamented by coarse frills and by fine ridges and sculpturings. White or gray or dingy, and sometimes the young are a brilliant scarlet, a color that is lost if the shell is boiled. The animal is commonly found clinging to sunken trash such as sea-weeds, piles or driftwood, and it thrives best in the warmer waters to the south. The range is from Santa Barbara, California, south to Cerros Island off Lower California.

(38) Leafy Horn-mouth. *Purpura* [*Ceratostoma*] *foliata.* Length: to more than 3½ inches. Breadth: to more than 2½ inches. Conspicuous because of 3 broad, wing-like structures that appear like shingles on a roof. There are also strong spiral ridges that spread out in a fan-like manner. Dull-white in color but commonly stained. It is more northern than the species just discussed and ranges from Sitka, Alaska, to San Diego, California.

(39) Sculptured Rock-shell. *Tritonalia interfossa.* Length: to 1 inch. Breadth: to ½ inch. Definitely spindle-shaped with the spirals marked by deep, well-defined grooves. Yellow, gray, brown and dull outside but white inside. While the shell is small, it appears coarse and rugged. The animal clings to the rocks and is relatively common along the whole of our Pacific Coast, ranging from Semidi Islands in Alaska south to San Diego, California.

(40) Wrinkled Thais. Purple Dog Winkle. *Thais lamellosa.* Length: to 2 inches. The exterior varies greatly, some being smooth while others are wrinkled or even frilled. Some are plain white, while others are conspicuously painted with rich brown bands. In general, these shells are more conspicuously colored or more elaborately marked when found in the northern part of their range. They are found from the waterline to depths of 150 feet or more and are not only common but usually popular with shell collectors. They range from Port Clarence, Bering Strait and southward, on the west to the Japan Sea; on the east, to the Aleutian Islands and south to Santa Barbara, California. The species has been found in fossil deposits of the Pliocene and Pleistocene of California and Oregon.

(41) Unicorn Shell. *Acanthina spirata punctulata.* Length: to about 1 inch, or sometimes 1½ inches. The spire in a mature shell has 4 whorls. There is a small aperture or openings bounded by a series of tooth-like knobs. The general appearance is like that of a waterworn piece of granitic rock that would be natural for the territory between the tide lines along the shore where the animal is commonly found. It usually is on rocks among sea-weeds. There are a number of closely related unicorn shells, such as the Angular Unicorn-shell, the Sad Unicorn-shell and the Orange Unicorn-shell, from which this is distinguished as the Spotted Unicorn-shell. It ranges from Monterey, California, to San Tomas, Lower California, with the relatives extending the range, particularly to the north.

FAMILY TRIVIIDAE. (42) Solander's Trivia. Sea-button. *Trivia solandri.* Length: to nearly 1 inch. Back, with a horizontal groove crossed by conspicuous ridges at right angles, the groove exposing the white area that underlies the colored surface. General color, dark chocolate-brown to light pink. This species ranges from Santa Barbara, California, south to Panama.

FAMILY CYPRIEIDAE. In this family are the Cowry Shells that are to be found in most collections, and that have been highly prized by modern and by primitive collectors. Our native cowries are relatively few, and are, for the most part, found in the warmer

seas. A cowry is likely to be in the collections of most members of our armed forces who return from the South Seas. In the Hawaiian Islands, they are used as bait for capturing octopuses that are used as food. They may be bought in the public market or from tourist shops. Ordinarily, they are not easy to collect.

(43) Chestnut Cowry. *Cypraea spadicea.* Length: rarely to 2 inches. In general, the color is brown but the lips on the under side are bluish and with about 20 whitish "teeth." The central part of the back is lighter brown than the adjacent area, with the outer margin much lighter. Young shells are thin, short-spired cones with a large aperture. The shell is rarely found, but is so highly prized and representative of so many popular shells from elsewhere in the Pacific, that it seemed best to include it here. It ranges from Santa Barbara, California, to Cerros Island, Lower California.

(44) Oregon Triton. *Argobuccinum oregonensis.* Length: to about 4 inches. The outside of the living animal has the shell apparently covered with a brownish hairy material so that the animal looks shaggy. The inside is pure white. It ranges from the line of floating ice in winter in the Bering Sea, near the Pribilof Islands, to Okhotsk Sea and Japan, and south to San Nicholas Island and San Diego, California. (Cymatiidae.)

(45) California Horn-Shell. *Cerithidea californica.* Length: to slightly more than an inch. Black outside and glossy brown within, with 10 strongly-ribbed whorls and a relatively large, nearly circular aperture that is closed by a thin, brown operculum when the animal withdraws to the shell's protection. The animals are found in the mud of tidal flats, seemingly undisturbed by being exposed to the air. They range from Bolinas Bay to San Diego, California.

FAMILY LITTORINIDAE. An Atlantic Coast periwinkle was discussed in the tenth insert of this series.

(46) Checkered Littorine or Checkered Periwinkle. *Littorina scutulata.* Length: to slightly more than ½ inch. Greenish to brownish-gray marked with lighter whitish bands or spots, and with the inside of the shell showing a conspicuous purple at the aperture. Found clinging to rocks between the tide marks and ranging from Kodiak Island in Alaska, south to Turtle Bay in Lower California and Socorro Island.

FAMILY CALYPTRAEIDAE. (47) Hooked Slipper Shell. *Crepidula adunca.* Length: to 4/5 inch. Shaped somewhat like a slipper or shallow boat but recurved at the tip, with the surface brown and the "deck" white. Younger animals have the point at the end sharp and less recurved. The range is from Vancouver Island, British Columbia, to Cape San Lucas, Lower California.

FAMILY NATICIDAE. Two Atlantic coast Naticidae were described in the tenth insert of this series. One other follows.

(48) Lewis's Bull's-eye. *Polinices lewisii.* Sometimes to 6 inches through, but more normally 3 or 4 inches in diameter. Yellowish-white, smooth-surfaced, and with the rather large aperture closed by a broad, horny, brown operculum. The animal is strictly carnivorous, preying for the most part on other shelled animals such as clams, through whose thick shells the Bull's-eye can drill a hole permitting access to the soft flesh inside. The Bull'e-eye has an unusually large foot and moves freely about in search of its prey. It ranges from Duncan Bay, British Columbia, to Santa Barbara Islands, California.

(49) White-cap Limpet. *Acmaea mitra.* Length: to about 1 inch. The shell looks like a small cone or tent, with the surface smooth and pure white. The animal is able to move about somewhat, but when disturbed clamps so tightly to the rock that it can hardly be removed without breaking the shell. If, before the creature is disturbed, a blade of a table knife is suddenly thrust under the shell, the animal is forced free easily. The animals are sometimes eaten by men, but are more commonly used as fish bait. The shells are sometimes used as ear-rings. The animal ranges from the Pribilof Islands, Bering Sea, south to San Diego, California. (Acmaeidae.)

(50) Wavy Turbine Shell. *Astraea undosa.* Length: to 4 inches. A pearly-white shell covered with a brownish fibrous skin, with the whorls variously wrinkled and ornamented. The operculum of the shell is horny within. Apparently, the animal is vegetarian. It ranges from Laguna Beach, California, south to Cerros Island, Lower California. (Turbinidae.)

(51) Black Top-shell. *Tegula funebralis.* Length: somewhat more than an inch, but more commonly smaller than that. Purple to black outside, but greenish-white and pearly as the outer layers are worn or broken off. There are normally 4 whorls of which the uppermost may well be worn off where there is violent wave wash. These animals are sometimes so abundant as to carpet the rocks exposed to waves, and the animals have the ability to fasten themselves relatively firmly to these rocks. They are eaten freely by fish. Range is from Vancouver Island, British Columbia, south to Cerros Island, Lower California. (Trochidae.)

(52) Ringed Top-shell. *Calliostoma annulatum.* Length: to about 1 inch. Beautifully and finely-engraved pointed cones, with the spiral grooves usually marked with deep purple, with the major color reddish or yellowish-brown. Some have stripes in violet rather than in purple. The edge of the lip is fine and thin. The animals do not live on the wave-beaten shore but on seaweeds in deeper water. On bright days they may be found near the surface, but in rough dark weather they retreat to the quieter depths. The range is from Forrester Island, Alaska, to Catalina Island, California. (Trochidae.)

(53) Puppet Margarites. *Margarites pupillus.* Length: about 1/3 inch. Yellow-brown. Whorls: four, and plainly marked with spiral ridges. Opening is nearly circular. The range is from Nunivak Island in Bering Sea, south to San Pedro, California. Here it is found in deep water off San Pedro. (Trochidae.)

FAMILY FISSURELLIDAE. Key-hole Limpets. (54) Rough Key-hole Limpet. *Diodora* [*Diadora*] *aspera.* Length: more than 2 inches, although usually smaller. Conical, with an elliptical base and with ridges and grooves radiating from the hole at the crest of the cone. The outside is dark purplish to gray-brown, and the inside is a pure pearly-white. The animals cling to rocks. The range is from Cook's Inlet, Alaska, to Magdalena Bay, Lower California.

(55) Blue Abalone. *Haliotis fulgens.* Length: to nearly a foot and about ¾ as wide. The spiral is almost obscure and the shell looks more like a broad, shallow, oval bowl with a number of relatively small oval holes in a line along one side. The outside is rough, coarse and frequently covered with other organisms so that the animal is not easily detected. The inside of the shell is a layer of mother-of-pearl, or nacre, rich in rainbow tints and glistening. The animal can remain closely attached to the rock since the holes permit the passage of the necessary water to supply the gills with their needed water. As the shell increases in size the older holes become filled and new ones appear.

So firmly can this shell grip the rock that it has been reported that divers who have attempted to pull them loose have been held under water. We have no authentic record of drownings having been caused by this, but it is obviously possible. It is for these shells (possibly collected elsewhere) that divers off Catalina Island amuse tourists cruising in glass-bottom boats. The diver points out one of these shells obviously placed on the bottom and offers to get the shell for the tourist—at a price. The shells have some commercial value. We have a dozen excellent specimens in which the holes have been plugged. They provide unique bowls for serving clam chowder and supplement the set of cockle shells from which we serve such side dishes as apple sauce, and the pectens on which we serve salads.

The flesh of the abalone has a definite commercial value, and in one year the abalone harvest in California weighed three times as much as all the Pismo clams, soft-shelled clams, sea mussels, cockles, Washington clams and bay mussels combined, the total being more than 700 tons of abalones in a single year. They may be bought as abalone steaks in the California restaurants or fish markets, or the animals are cut up and used in making chowders. Their harvest is subject to certain legal restrictions as to size. This species ranges from the Farallones and Catalina Island, California, south to the Gulf of California, Mexico. (Haliotidae.)

Class Amphineura

(Plate 4, Number 56, Page 197)

The chitons, representative of the Class Amphineura, possesses plates described by some as looking like a set of false teeth, by others as looking like a section of a tiled floor. The central ones have been described as butterfly shells. We choose as a representative the following.

(56) Mossy Chiton. *Mopalia muscosa.* This strange animal is up to about 2 inches in length, and apparently composed of jointed sections bordered by a fringe of moss-like hairs. The outside is, in Nature, usually covered by foreign growths that obscure the tile-like upper plates. The interior is bluish-green. The animal may be removed from the rock or other solid substance to which it is attached by inserting a knife blade under it. If one attempts to make a specimen of the shell and removes the flesh-like girdle, the shingle-like plates will fall apart. They are sometimes dried flat on a piece of wood or placed in some liquid preservative. This species ranges from Shumagin Islands, Alaska, south to Rosario in Lower California. (Mopaliidae.)

As We See It

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The Rat Menace

In the December number of the "Service Survey," house organ of the Fish and Wildlife Service, we note an item that seems particularly timely. It is reported that the Louisiana State Health Department has seized and condemned food materials in New Orleans warehouses, because of rat and mouse contamination, as follows: Flour, 33,000 pounds; rice, 20,000 pounds; beans, 25,400 pounds; grits, 87,900 pounds; sugar, 4,284,400 pounds; coffee, 1724 bags; onions, 7150 pounds; salt, 1200 bags. Because of the quantity, and for other reasons here stated, the sugar item seems of special interest.

Nearly forty years ago, when the U. S. Biological Survey was a small and relatively unknown bureau, the imported house rat, "the most destructive animal in the world," became the subject of special and far-reaching investigation. The first studies were made in Washington, D. C., where a straggling water-front, embracing several miles of tidal flats, marshes, rip-rap embankments and wharves, bordered by open waste land, provided ideal habitat. Food supplies in great variety and abundance were constantly arriving, and with open sewers and wastelands and ill-paved streets serving as highways for a constantly over-crowded rat population, a fertile field for rat study was at hand. Local studies were supplemented by investigations in other parts of the country, and no phase of life-history, food habits, rate of increase, cost of maintenance, relation to human diseases, or methods of destruction by traps, poisons, fumigation or electrocution, was neglected.

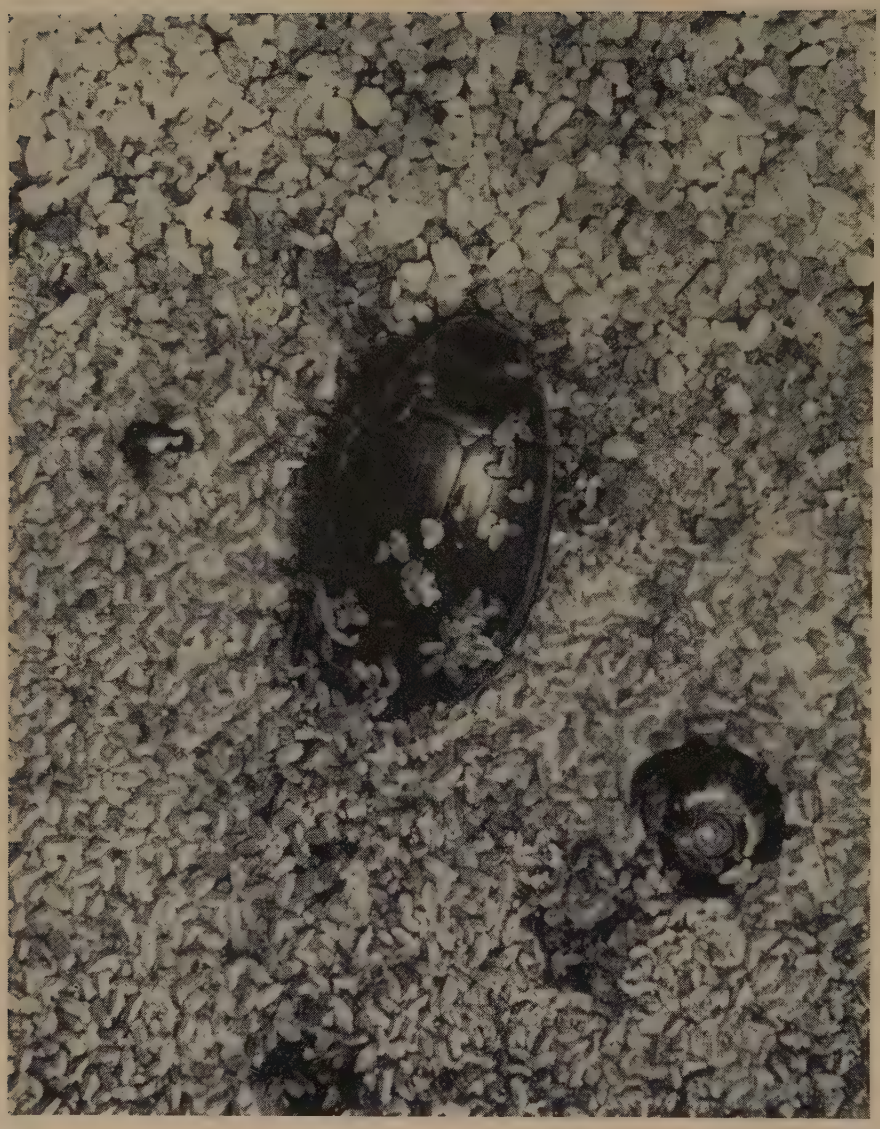
From 1907 on the Biological Survey published the main results of its studies in various bulletins that ran into numerous editions. A motion picture, based in part on the classic lines of The Pied Piper of Hamelin, was produced. The statement that rats "bit the babies in their cradles" was proved anew, for infants in Washington were so bitten, and some died from the resulting infection. Methods of excluding rats from residences and warehouses were worked out by the Biological Survey and the U. S. Public Health Service, and these methods were widely publicized. Besides governmental efforts, the subject was studied widely under State and city auspices. Prominent among the results was an illustrated bulletin of more than one hundred pages by Edward H. Forbush, then State Ornithologist of Massachusetts. A bulletin of sixty-six pages, containing the gist of the data in the Forbush publication, was issued in November, 1916, by the Missouri State Board of Agriculture. It quotes from Forbush the summary: "The Rat—the most expensive animal that man maintains; forerunner of famine, disease and pestilence. Disseminator of the dreaded trichina and the terrible bubonic plague, or 'black death,' which has slain its horror-stricken millions since the dawn of history, and now has spread to the United States."

One result of the Biological Survey's work on the rat was the establishment in France, during the first World War, of a unit devoted to the control of rats in the supply depots of the American armed forces. Whether or not there is a similar system of rat control in our far-flung theaters during the present great conflict we do not know. It is evident, however, from the record of food destruction in one city, that the lessons of the past in this regard are not fully appreciated. It is hardly likely that rat damage is confined to New Orleans, but we hope that no such volume of so vital a food as sugar has been destroyed elsewhere.

Surely, with the knowledge now available for the protection of food supplies, some individual or agency should be responsible for the loss of four million pounds of sugar, and several tons of other food stuffs, in one locality.

In a recent leaflet distributed by the Sugar Research Foundation of New York, there appears a list of about 150 modern uses for sugar, nearly half of which concern critical preparations; one of these is rat poison. We cannot help wondering whether some proportion of the four million pounds of sugar condemned might not have undergone some process that would have left it available for so useful a product as rat poison.

Important as is food destruction by rats—and a rationed public will have no illusions about that—the potential menace to public health is even greater. Health authorities in port cities are seriously concerned for fear that bubonic plague may make its appearance in epidemic proportions. Municipal health authorities face greatly increased rat populations without either the means or, it often appears, the ability to meet them. Yet the weapons are all forged, and the knowledge of how to use them is at hand. We may escape epidemics brought about by rats, but it will be due to good luck, rather than good management.



The World's Tiniest Flowering Plants

By MYRON GORDON

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Duckweeds are small enough to be carried on the backs of diving beetles and flying beetles, thus being spread from one pond to another. On the facing page is a picture of a handful of duckweeds of the species *Lemna minor*. Photographs by Lilo Hess.

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IF YOU keep a fish-tank, the chances are that your aquarium harbors many of the world's smallest flowering plants, the tiny duckweeds. Outdoors, too, the surface of nearly every body of standing water in most parts of the country is green with myriads of these simplified plants. Yet only a few persons, even among trained and specialized botanists, have seen their flowers. This is so because these plants flower rarely and for a brief time, and, when they do, their flowers are so minute that one needs a magnifying glass to see them.

The duckweeds, or Lemnaceae, represent a group of floating plants of great economic importance in wildlife conservation and wildlife management. They provide food for fishes and birds. Ducks particularly relish the plant, and for that reason it is often called "duck-meat" as well as "duck-weed." In addition to the vegetable food, which these aquatics provide directly, they attract many insects and other kinds of lower animals, which, in their turn, make up additional food for wildlife.

During late summer, the surfaces of ponds are often covered so completely with duckweeds that they appear carpeted with rich-green, finely-pebbled rugs. As new water areas develop, they are rapidly stocked from near-by regions by individual immigrant plants hitch-hiking on the feet and bodies of aquatic birds and wading four-footed beasts. The duckweeds are even small enough to find a berth on winged fresh-water bugs and beetles.

The smallness of the plants of *Wolffia*, one of the Lemnaceae, and the minuteness of its flowers, were discovered in Egypt almost a century ago. The English botanist Weddell, a member of the French expedition of Castelnau in 1849, found a second species, *Wolffia braziliensis*, on the feathers of an aquatic bird that he collected on the Paraguay River in the Matto Grosso region of Brazil. Curiously, these tiny-leaved aquatics were found living side by side with one of the largest known flowering aquatics, the gigantic waterlily, *Victoria regia*.

The duckweeds in this geological age are entirely aquatic. They were not always so, for they, like all flowering plants, had landlubber ancestors. Proof for this land origin of *Lemna* was neatly demonstrated by the experiments of the English aquatic botanist,

H. B. Guppy. This is the same Guppy in whose honor a common aquarium fish has been named, because he was one of the first to collect it during his explorations for aquatic plants in the West Indies and northern South America. Guppy found that duckweeds are capable of growth if stranded on mud. Under laboratory conditions, at least, they may fulfill their entire life cycle on moist earth, growing by budding at all seasons of the year.

Duckweeds, although tiny, make up for their small size by their tremendous numbers and by their remarkable powers of vegetative reproduction. A single individual duckweed may multiply to several millions in one season. Dr. Lawrence E. Hicks of Ohio has estimated that compact floating mats of the largest duckweeds contain from 100,000 to 200,000 plants per square yard of water surface. There are 300,000 to 800,000 plants per square yard for some of the species of *Lemna*, and 1,000,000 to 2,000,000 per square yard for the tiniest of the tiny duckweeds, the members of the genus *Wolffia*. These run 4,575,000 to the pound.

To the evolutionist, and to scientists studying the interplay of hereditary and environmental effects, the duckweeds are fascinating laboratory specimens. The duckweeds, today, are among the most simplified of vascular plants, yet they were not always simple; their simplicity has been attained secondarily. Dr. Hicks describes a typical duckweed as consisting of a flattened stem with one node and parts of the two adjacent internodes fused with rudiments of the original leaves or petioles. He claims that there is no botanical term now available that is correctly applicable to this structure. He simply speaks of them as "shoots," or just "plants"; other botanists call them "fronds." What apparently has happened is that the duckweed has telescoped its structural parts.

The simplification of the duckweed plant has been carried to the point of union of stem and leaf, and their fruiting bodies, which are hardly ever seen except by the expert botanist, are also reduced to bare essentials. Even here, the evidence seems to point toward ultimate elimination of these specialized fruiting organs, for they develop rarely. In one species, *Wolffiella floridana*, the flowers have never been seen by man, and some botanists, like Dr. Hicks, say that the evolutionary development of this plant has been such that the flowering potentiality apparently has been completely lost. He regards it as unlikely that flowers are ever produced in Nature by this duckweed. He subjected them to more than one hundred physiological tests, many of which proved successful in inducing flower development in some of the other Lemnaceae, but he got nowhere with *Wolffiella*. It seemed to depend entirely on budding.

The simplification of their structure in the floating Lemnaceae seems to be directly correlated with their mode of life upon the water. Wind and water currents constantly turn their bodies round and round, but this cannot keep them overturned long, for tiny air chambers in the upper half of the leaves tend to keep the small floating plant-rafts right side up. Other water plants are not so fortunate. Eel grass, *Sagittaria*, for example, is frequently destroyed by exposure—when uprooted and drifting upon the surface. Such plants are overpowered by the unusual intensity of light at the surface, as well as the drying power of strong winds.

Of twenty-six species of Lemnaceae known in the world, thirteen have been found in the United States, some in every state in the union. The species of

One of the largest and one of the smallest of the aquatic plants of the world were discovered living side by side on the Paraguay River in the Matto Grosso region of Brazil. The leaf of the gigantic water-lily, *Victoria regia*, measures four feet in diameter. The tiny duckweed, *Wolffia brazilienses*, measures about one-sixty-third of an inch in diameter. More than seven millions of the duckweeds could find room on one Victoria water-lily pad. Photograph from Keystone View.

Spirodela are the giants of the group, measuring about a quarter of an inch. One characteristic in addition to their size, which distinguishes them from the members of their neighboring genus, *Lemna*, is that each group of plants of *Spirodela* has more than one root. *Lemna* has but one root, and the other members of the family have none.

The members of the genus *Lemna* are best known to the aquarist. Of the various species of the genus, *L. minor* is the one most commonly associated with the name duckweed. It is found around the world and is the commonest member of the group. Some say that *Wolffia* is equally ubiquitous, but is often overlooked because of its minuteness. When both *Lemna* and *Wolffia* are found side by side, many inexperienced observers erroneously think that the tiny green dots are the immature stages of *Lemna*, when, in reality, they are whole plants of *Wolffia*.

Careful scientific tests by Dr. Hicks have definitely shown that *Lemna minor* has the greatest tolerance for extreme acid and alkaline conditions, a spread from pH 4.4 to 7.9. Consequently, it has the widest range.

The Lemnaceae are completely dependent upon their aquatic medium, not only for moisture, but for mineral food as well. Yet, in spite of the fact that all its minerals come from its aquatic environment, the plant contains chemical (Continued on page 218)

It is difficult to picture the tremendous abundance of duckweeds. They are so minute that an area completely covered appears not covered at all. Note the small trangular black space just this side of the boat—the only spot not covered with duckweeds. The boat is specially designed to rake these surface plants and submerged ditchweeds from Buckeye Lake, Ohio. About 1,000,000,000,000 of the average sized duckweed, *Lemna minor*, would cover a surface area of one square mile. Photographs by Lawrence E. Hicks.

In 1933 Lawrence E. Hicks found a mat of *Wolffia* one inch thick covering this southeastern tip of Buckeye Lake. High winds had crowded most of the plants to this area. The plants number 2,000,000 plants to the square yard of water surface. This enormous mat was too much of a good thing, suffocating hundreds of fishes. Attempts to remove the duckweeds were given up after 650 wheelbarrow loads—4,500,000 plants to the pound—were taken out with no noticeable change. Note the tree shadows on the snow-like surface.

Shell Craft

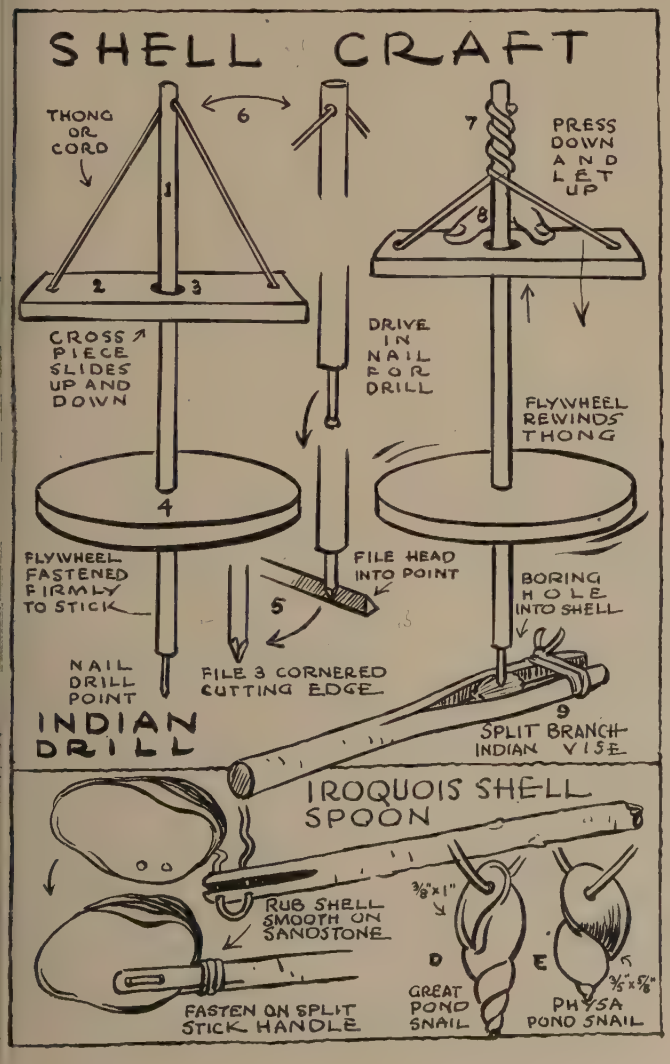
Another Nature-Craft Article

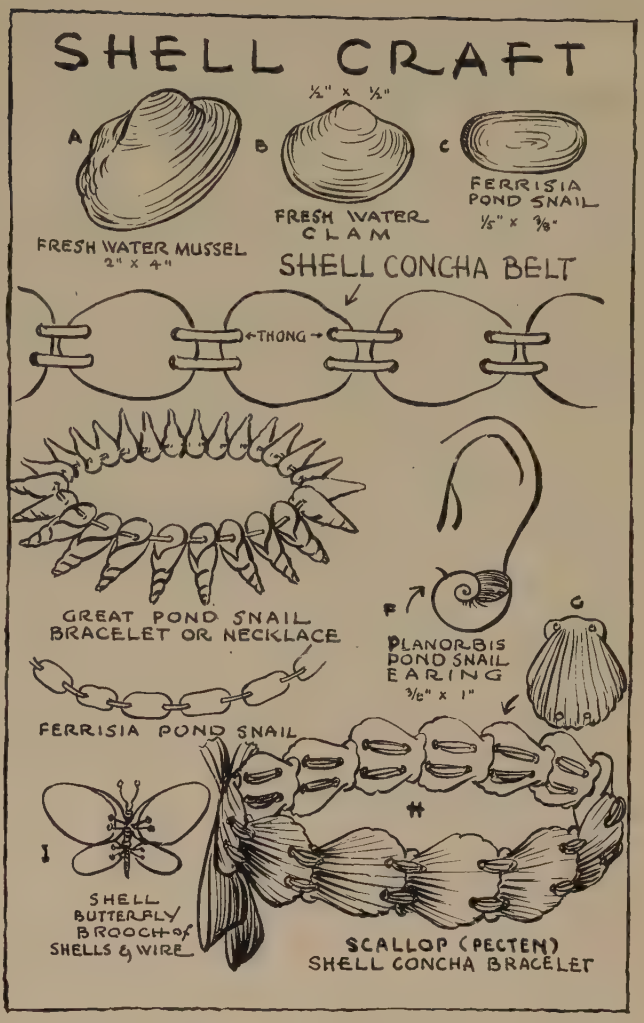
By ELLSWORTH JAEGER

COLLECTING the numerous and beautiful shells of our various mollusks of streams, lakes and seashores is a fascinating occupation in itself, but, when inter-related with handicraft, it becomes all the more absorbing. An imaginative Nature guide can present much Nature lore, in an unobtrusive way, to those whose interest is in the use of things, and stimulate a greater interest in Nature by first showing how her materials may be used.

Shells, for instance, may be made into numerous craft articles—pendants, earrings, bracelets, conchalike belts, shell animals and birds, and various utensils such as spoons and cooking accessories. Our shellfish or mollusks are a numerous family, and the seashore and freshwater streams, lakes and ponds all afford excellent hunting grounds for these interesting creatures.

Some of our pond snails are commonly found in fresh water. Their shells vary in shape from the flat-





tened shells of the *Ferrisia* pond snail (C), the coiled shape, as in the *Planorbis* (F), to the twisted whorls of the *Physa* (E) and great pond snails (D). The fresh water clam (B) is a small bivalve about a half-inch wide and long. Another bivalve, a large fresh water mussel (A), is about two by four inches.

Mollusks have only one foot, and the snails, when traveling on land, make a sticky trail of mucus. This material is also used by snails and slugs as cords for climbing or lowering themselves from plants. Water snails sometimes use the mucus for a float with a thread attached so that the snail can climb to the surface occasionally for air. In winter snails may place a film of mucus across the shell opening as a storm window.

The fresh water mussels (A) are found in the mud of streams and ponds, and their shells are used commercially in the making of pearl buttons. Like the oyster, they often build pearl around some foreign substance inside the shell. The eggs hatch in the gills of the female, and the young, when free, attach themselves to fish for ten days. After this parasitic period they drop off and are on their own. The shells of the fresh water mussel may be used for cooking shredded or deviled fish, in making spoons or ladles or conchas.

The various pond snail shells may be made into

pendants, necklaces or earrings. To make these, holes must first be bored in the shell and a drill will be necessary. Long before the coming of the white man, the Indian bored holes in shells with a cleverly-devised pump drill. This type of drill can easily be made from materials at hand.

To make this tool, a rounded stick about eighteen inches long (1) will be needed, as well as a crosspiece (2) about ten by two and one-half inches and one-half inch thick. A hole is bored at each end of the crosspiece to hold a thong, with a larger hole in the center so that the crosspiece may slide easily up and down the stick (3). A fly wheel (4) is constructed of one-half inch wood about nine inches in diameter. For a drill point a nail is driven into the lower end of the stick and the head filed into a point (5).

In assembling the drill the fly wheel is fastened tightly to the stick about a third of the way from the base. The top of the stick is then inserted into the center hole of the crosspiece and a thong, or twine, fastened at both ends of the crosspiece is threaded through the hole at the top of the stick (6). The operation of the drill is simple and almost automatic. The drill point is placed upon the object to be bored and the thong is wound about the drill stick (7). Press down upon the crosspiece (8) and let up before the thong is entirely unwound. The fly wheel will continue the movement and will rewind the thong for another downward stroke. In this way a continuous and rhythmic drilling is kept up and the hole is soon bored through the object.

A simple Indian vise may be made to hold the shells for drilling by splitting a stick part way, inserting the shell and binding the end of the stick securely with a thong (9). Flat sea shells, such as the scallop, may have two holes bored at each end (G) through which thongs or ribbons are threaded (H). Both belts and bracelets may be made in this way. Shell butterflies (I) may be made from two different sizes of shells. Holes are bored into the shells and the two parts are then wired together. The body of the shell butterfly is fashioned of twisted wire.

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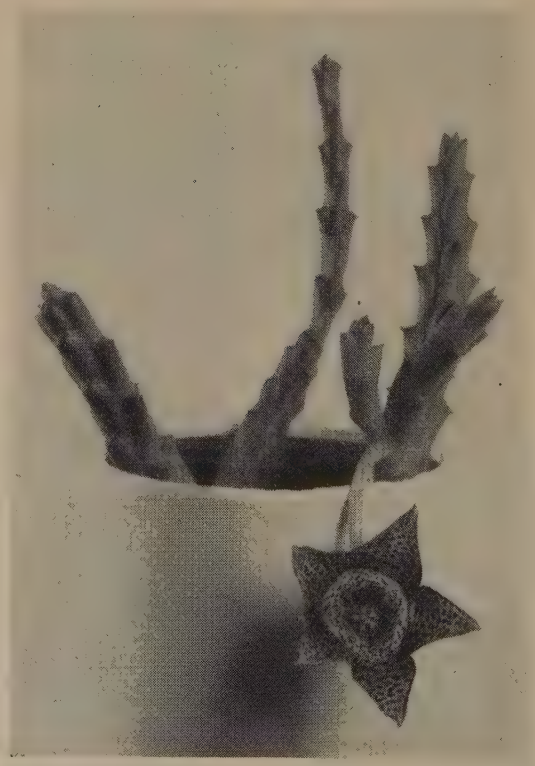
The Carrion Flower

By RUTH CARWELL KESPOHL

FRAGRANT as a flower!—not if we are speaking of *Stapelia*, a genus of succulent plants coming originally from South Africa. I was much surprised, when I moved my little daughter's neglected specimen into the house just before the first frost, to find a protruding stem growing from an angle of the plant bearing a five-sided, flat-topped bud. After several days it opened to reveal a curious flower. Five fleshy, greenish-yellow petals were covered with purplish-brown spots. Its carrion-scented odor drew a lingering house fly who promptly found himself stuck fast. A florist friend explained that eventually its tissues would be broken down and dissolved by the plant—a sort of natural flypaper.



The flower looked quite out of place among our prosaic Missouri geraniums and begonias. It is found, for the most part, only in botanical gardens or among collections of succulent plants. Nor does it bear any superficial resemblance to the milkweed family, to which it belongs. Words can not express the emotions that the flower aroused, or describe its spell. It called to mind distant lands, teeming jungles, darkness, even huge snakes. There seemed to be something evil lurking in its appearance.

But one morning, after about ten days, the petals had closed so they looked much the same way as they had before opening, and the spell was broken. *Stapelia* was again just an interesting window garden plant, still plainly an exotic, but without some of its eerie qualities of previous days.

Mr. Monagher and the Moth

By ELOISE ENNIS

VIEWED from a purely financial angle, Mr. Monagher was not a success. Small and round of stature, he continually bore an air of self-effacement and apology. However, he had, somehow, perhaps in his more assertive youth, possessed himself of a remarkable family—a charming and quite efficient wife, two sons and a daughter. His children were nice to look at and brimful of energy—to put it mildly—and both beautiful and buxom. But Mr. Monagher's rollicking, fun-loving family only seemed to dwarf his own uncertain personality the more. He made his livelihood, and fed his family, by the grace of Mrs. Monagher's brother, who maintained a successful business and who paid Mr. Monagher sufficient salary to keep his family in both dignity and decency, which general arrangement, I am sure, did not add measurably to Mr. Monagher's self-esteem.

We first knew the Monaghers when they rented a house from us; and well I remember the first day the rent was due and Mr. Monagher presented it to us, apologetically, five dollars short. He explained, blushing, that if he did not withhold the five dollars, he could not go fishing—a trip he had planned for a long time to a spot he knew where the fish were biting. His eyes held a quiet pleading that could not be denied. This was the first of many fishing trips for Mr. Monagher that summer, and often at the expense of the rent.

And so life went on with the Monaghers that summer and the winter that followed. Mr. Monagher daily became more pinched, his shoulders a little more stooped, his general mien still more apologetic. Definitely, by that time, we had cataloged him. He was one of those unfortunate individuals commonly said to have "missed the boat." He was almost an abject failure. So we found ourselves paying little attention to him as he went along his quiet, almost humble, way.

Then with a great burst of sweet-scented air, borne along on soft, exotic breezes, it was suddenly spring again; then summer once more, and we spent a great deal of time digging in the soft ground, feeling the sun hot on our backs. Mr. Monagher could also be seen working in his yard, diligently, unobtrusively, saying little.

It was one of those lazy, too-warm days of early summer and Mr. Monagher lay prone and seemingly listless in a deck chair in his back yard. I glanced at him now and then from my side of the fence as I squashed tiny border plants down into the earth. Then, suddenly, Mr. Monagher's children were there, showing him something in a glass jar. Even from my peep-hole beyond the fence, I could see that it was a giant moth dressed in a delicate and beautiful blending of colors.

"See it, Dad! Isn't it beautiful?" the littlest boy cried. "We caught it and got it into the jar."

"I wonder what it eats. How do you suppose we can keep it alive?" asked practical Betty.

"Keep it alive!" This was big brother talking. "I'm going to kill it, put a pin through it and put it up on a board. I'm going to start a collection."

Mr. Monagher turned the jar around carefully, studying the moth from all angles. "Yes," he said finally, "it is very beautiful; and now that you have seen it and enjoyed the full beauty of it, you must let it go."

"Let it out of the jar?" they cried in amazement.

"Yes," Mr. Monagher replied firmly. "Life is difficult enough at best, without making it still more difficult for any living thing."

The children were silent a moment; and then, because they were unusual children, or perhaps because they shared some deep understanding with their father, they slowly removed the lid from the jar and watched the trembling, frantic wings as the moth released itself from its prison and soared above them, exultant in its freedom. The children replaced the top on the now empty jar as they watched the erstwhile prisoner wing away.

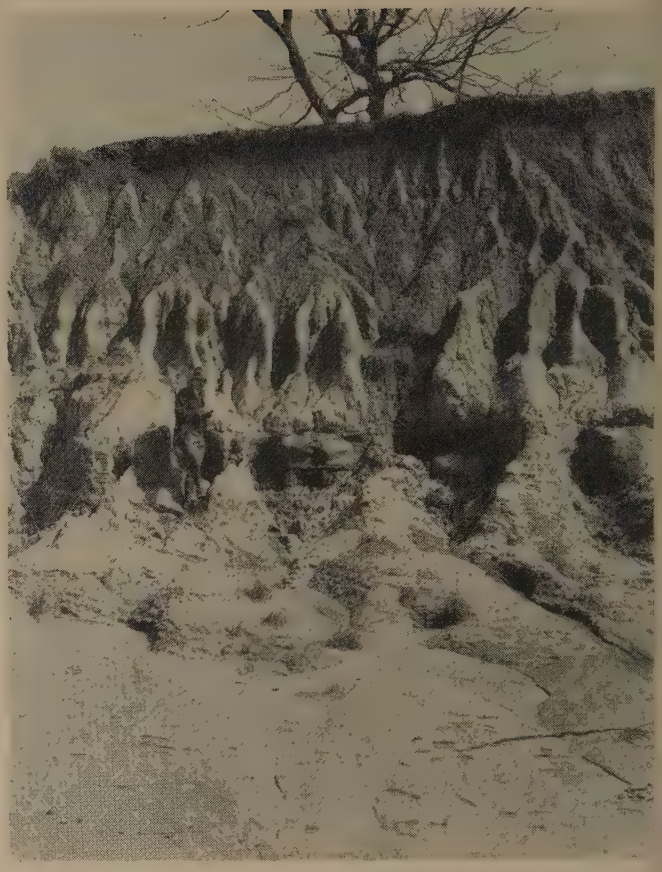
But to me, in those few short moments, Mr. Monagher had suddenly grown in stature. He no longer seemed the ineffectual being of whom we had been only vaguely conscious for the past many months. Mr. Monagher, I suddenly realized with consternation, possessed the elements of true greatness.

Birth of a Luna Moth

By INEZ BARCLAY KIRBY

My eyes have watched a miracle unfold:
Beauty emerging from an awkward thing
Whose untried feet had scarcely strength to cling
Upon the twig with insubstantial hold.
I saw a formless clod of dusty gold
Assume the grace of tender leaves in spring,
The slow unfurling of each radiant wing
Stamped with the full moon's signet, clear and bold.

Not to my duller sense, to him alone
Some whispered impulse came, some imaged flight
That set him trembling like a wind-swayed flower.
A call, a fragrance charged his wings with power;
He rose and fluttered through the waning light
With love for guide on strange ways and unknown.



Elemental War

By RAYMOND TIFFT FULLER

As YOU look at the photograph at the left you think of wild Wyoming, of Dakota's Bad Lands, or even, perhaps, of The Hump, our flyers' skyline Burma Road over Tibet.

Then you see the photograph at the right. It is *excropland along Tobacco Road!* It is a sort of Lidice or Aachen of the dirt! The second picture was snapped simply by backing up a few dozen steps. Not even a few dozen centuries will put back humus on this spot on the map of Georgia. These two candid shots are a pair from more than a dozen taken in this vicinity a little over a year ago. The writer believes that no amount of repetition of this dismaying subject of man-caused erosion should bore the American public to the point of indifference.

Like a military set-back—if any—along the Siegfried Line or in the West Pacific, this sort of uncensored "news" ought only to arouse us Americans to this tough home-front task in our war against the tyrant Waste—alongside which Hitler is a piker. We have to fight, indeed, and now, to make our country, as well as the world, "a decent place to live in" for our children's children. Let us have Conservation—as well as Peace—"in our time!"

★

Rain Night

By ALLEN E. WOODALL

Storm again tonight, and the road is brown
In the dark green night, as the rain comes softly down,
And the frogs are loudly glad and the trees rejoice,
And the night is full of the rain's incessant voice,
Till the wind sweeps through with news of another day
And the trains cry out in the valley far away.

A winter picture taken at the Seventh-Day Adventist Mission Compound and looking down the Kialing River to Chungking, a couple of miles away. The bare areas on the hilltop to the left of the banana leaves are the garden flats in which the author first discovered Hung Han Tsai, or Tampala, as it is now becoming known to gardeners.

From a Chinese garden on a hillside outside the city of Chungking came—

Tampala, Garden Immigrant

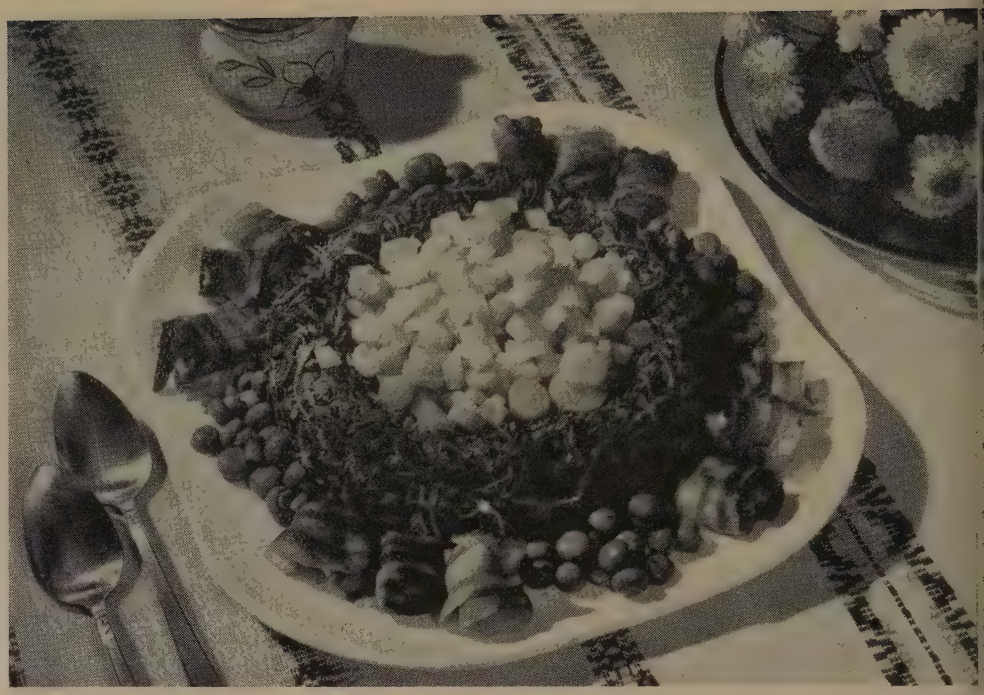
By EARNEST L. LUTZ

THE great Red Basin of Szechwan Province in western China includes a large block of territory lying north of the Yangtze River, and between the mountain barrier that marks the limits of the extensive plains of central China and the foothills that lead up to the massive mountain ranges of central Asia. There most of the important rivers of the Orient have their source. In general aspect this area is a huge triangular basin rimmed on all sides by mountains. The troubled waters of the "Son of the Sea"—a literal translation of Yangtze Kiang—skirt the full length of the southern side of the triangle to find its only outlet in the rocky rim through the Wind Box Gorge, immediately below the artesian salt wells near the city of Kweichowfu.

From the red pyramidal mountains, beginning west of this city, to the far limits of this important section, the country is cut by irregular watercourses, both large and small. These run in the bottom of narrow valleys, from which spring, tier upon tier, the terraced fields that reach up to the ridges and end in delightful corries of circling fields. From the top of one of these weather-worn ridges, a little higher than its neighbors, one might see from eight to twelve other crests, looking in any direction.

The Red Basin is about as large as the State of Oregon, and in that extensive section the only level portion of any extent is found on the Chengtu Plain, which is about one-twentieth of the whole. Regardless of its forbidding aspect, we find this to be the richest part of China. The climate favors agriculture, and as many as three or four crops can be raised in one year on much of its land. In spite of rather poor communications through the centuries, famine has been almost unknown, although the population is almost unbeliev-

The red and green variegated foliage of Red Tampala makes it a striking plant, as decorative as it is delicious as a source of greens for the table. Frequent harvesting of the leaves and stems, both of which are used, seems only to add to its long period of growth.



A delectable dish, with Tampala playing the principal role. In the center are slices of the stem, which are distinctive and delicious in taste, while surrounding these is a wall of the cooked greens. (Editor's Note: For two summers we have grown this vegetable and enjoyed it greatly. We particularly like the stems, broken up and cooked like asparagus.)

ably dense. With the exception of cotton and certain medical items this Inland Empire is almost independent of the rest of the world for the necessities of life. On the other hand it has supplied many products for export; the most important among them have been large quantities of tung oil, raw silk, and white insect wax; it has been one of the world's main sources for bristles.

Along with the mountains on its edge, the Red Basin has been a paradise for the naturalist and the scientific scholar. They have come and spent years to learn its botanical and zoological secrets. In the mountain regions on the northern and western borders renowned hunters have sought and found the elusive giant panda and other rare animals. Professional and amateur archeologists have probed the mysteries the earth has held. In the now dim past these hills were inhabited by non-Chinese mongoloid peoples. These have gradually retreated into the higher mountains to the southwest before the better organized and more industrious Chinese, while a few have persisted in the country of the giant panda. Among these the ethnologist finds many interesting and tantalizing problems. Here are peoples, nations and tribes that are unique in dress, language, culture and religion.

This is a wonderland for the lovers of Nature. There are new and strange forms among the beasts, the birds and the fishes. Growing things range from the stately yellow cow horn tree—a banyan tree peculiar to this area, clinging to a rocky ledge—to the fragrant flowers that grow out of the crevices among the serpent-like roots that reach long arms down to the soil below the cliff. There are plants from which fine linen is made; plants for beauty, and a multitude for food. We were surprised to find red carrots that were nearly a foot long; crisp and finely-flavored radishes nearly as large as mangels; spindly scallion-like onions only a little larger than a pencil and fifteen to eighteen inches long; tasty woolly berries, *Actinidia chinensis*, that are as large as plums. In the winter we were treated to the most interesting Mandarin oranges. Many of these loose-skinned oranges were larger than a baseball, and varied in flavor, some resembling strawberries and muskmelon. There was a variety of legumes, and leafy green vegetables seemed to be legion. It is in the spring that one may be fortunate enough to find Hung Han Tsai—Tampala. We found it by chance.

One late winter or early spring morning I rode away from our home on the steep hillside above the Kialing River just outside the city of Chungking. The road meandered over the rounded ridge that was parallel to the river, while on either side of the two-foot flagging were many vegetable plots. The soil here is red and lumpy, and defies the farmer's art to reduce it to a fine seed bed. Among such clods I saw a farmer, carefully and with the swing of an artist, scatter some very small black seed. I watched that particular plot as I went to and from the city, and one day I saw small, reddish, seed leaves coming up among the clods. As the plants grew the edges of the later leaves showed a green border with a bright red strip down the center. These plants were beautiful as the early morning sun lighted up the red and brightened the green. I came to wonder what they could be for.

One day the cook proudly brought a bunch of the plants with the colorful leaves. They were, he said, a delicacy, and usually used for feasts and special occasions. At lunch we were delighted with the discovery of the finest greens that we had ever eaten. The Chinese name—Hung Han Tsai—means red salty-vegetable, and we found that it did have

lightly salty taste, which may indicate a favorable mineral content. Soon, too soon, the crop was exhausted, but each spring we enjoyed it for a limited time.

It was imperative that we return to the United States in the spring of 1924. A few days before we started for home I asked a Chinese gentleman, who knew some farmers, to obtain a small quantity of seed of red-salty-vegetable, and also of two other varieties of vegetables. He brought me about a teaspoonful of white-salty-vegetable seed, which he said was considered the best. I was disappointed, but it was too late to do anything about it. In the fall of that year some of the seed was planted near San Diego, in southern California. This planting was a complete failure, partly because I did not recognize the young plants from weeds that came up at the same time, and partly because, as we learned, it is strictly a summer grower. The remainder of the seed was put away for another trial in the spring. Before planting time came again circumstances moved us to a retreat in the San Bernardino Mountains, and the package containing the seed was somehow lost.

One day, however, I was taking inventory of my personal desk drawer. When it was finally emptied I lifted the lining paper and was thrilled to find a few of the precious seeds that had sifted out of the package and found their way under the paper. This was in 1932, and the seeds were at least eight years old. Would they grow? White Han Tsai was better than no Han Tsai. I would try.

Only a part of those few seeds was planted when the weather grew warmer, and, to my surprise and delight, I found the seed leaves of a red plant; then two more. These seedlings survived several late frosts and became beautiful young plants, which I set in the choicest part of the garden. There they flourished and surprised us with their beauty and size. By mid-summer they were more than eighteen inches in diameter and about three feet high. We did not dare use any of it for food as we wanted the seed, the only seed that we knew of outside China. There were a few so-called white plants, too, although they are really light-green-leaved. Only two of these survived, but, by mid-summer, made wonderfully compact bushes, and we risked using at least enough for one meal. We picked branches four to five inches in length with the leaves attached and cut them into short lengths, cooking both the young stem tips and leaves together for five minutes. To our delight the flavor was fine, only a little less so than our memory of the small plants we had had in China, and we were both surprised to find the young stems fully as tender as the leaves.

We concluded that we had discovered the outstanding possibilities of *Amaranthus gangeticus*. Later we learned that it is cultivated in many parts of Asia, and used more extensively for food in Burma, and, possibly, in India and Ceylon.

The three red plants produced several ounces of seed, and some of it was sent to the United States Department of Agriculture Experiment Station at Beltsville, Maryland. In 1933 we set out a patch of Hung Han Tsai on a plot of ground that measured twelve by forty-five feet. The plants were set one foot apart in rows three feet apart. As the plants grew, the pretty, large, red and green leaves were the attraction of our corner to passers-by, who stopped to look, ask, and be surprised that these plants were for food. Most often they were given a bunch from an adjoining plot, and when they came again it was to ask for seed that they might grow it in their gardens.

Beginning in 1934, seed was sent to experiment stations, colleges, seed companies, growers and a host of friends, but it was not until 1942 that David Burpee, seedsman and horticulturist of Philadelphia, was willing to venture the commercial production of the seed. He had been growing it and testing it for several years. The name tampala was selected, for commercial and pronunciation reasons, and because it was the word used for this plant in Ceylon. Red tampala needed some trueing up before it could be offered to gardeners this year. For this reason white tampala, or, simply, tampala, appeared first in 1944.

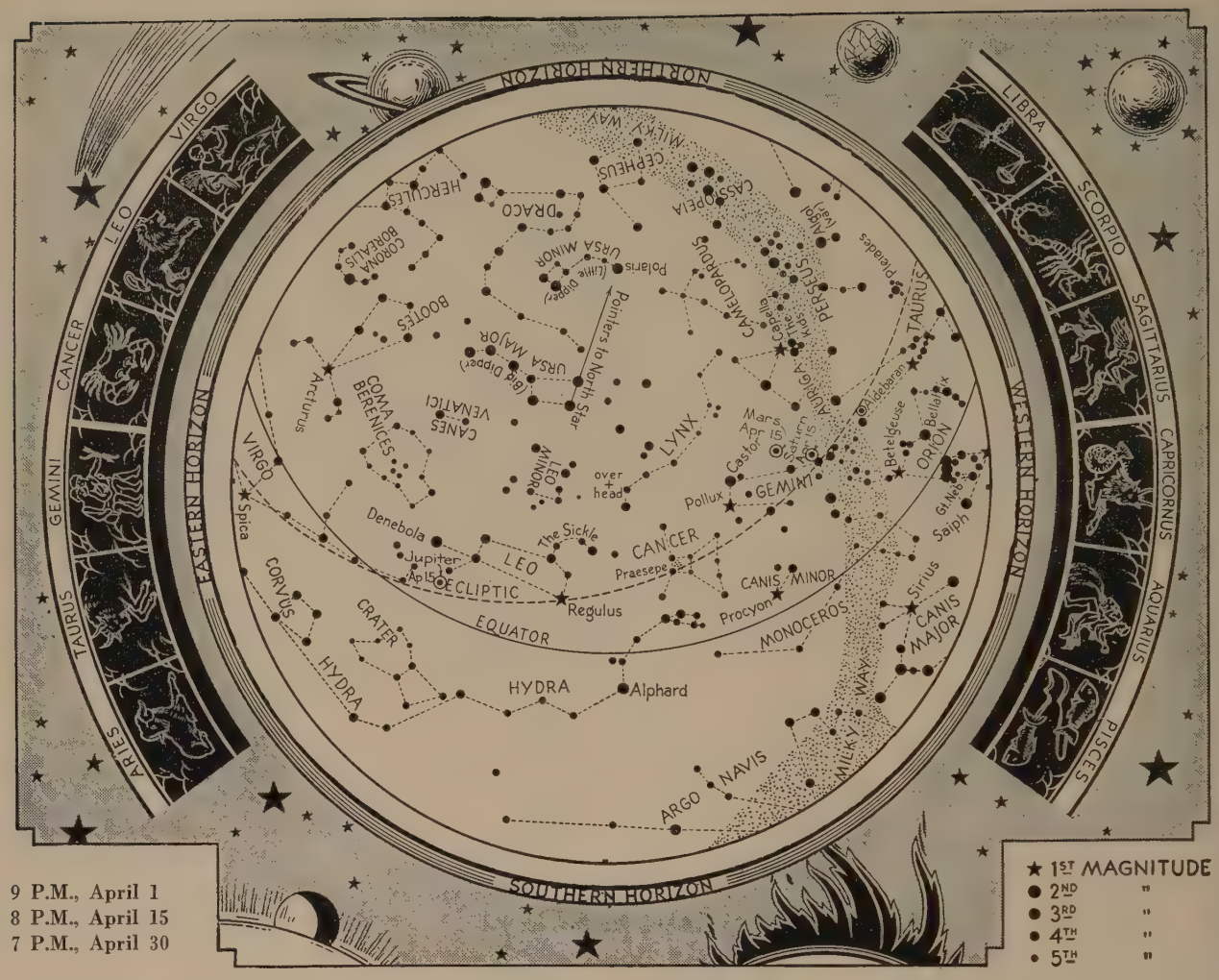
Tampala has a long period of usefulness because the leaves and stems are tender until the plants go to seed, which does not occur until the days become much shortened in the late summer or early fall. In good growing weather, and in ordinary soil, it will be ready for use in from six to eight weeks, and pickings may be made from it all summer. For a continuous supply of the most tender leaves the gardener may make several successive sowings, ten days or two weeks apart, and use entire plants when they are five or six inches high. The leaves and stems may be cooked together or separately, or the leaves may be used in raw salad.

Attempts have been made to discover the full value of tampala as food for those who enjoy good health and for those who are (Continued on page 216)

New Leaf

By MAREL BROWN

This leaf becomes a pledge for life's desires,
Its surety for faith, its vow for hope;
This resurrection from the autumn fires,
A staff of courage for the upward slope.
No system can appraise its final worth,
No science name one least component part.
Its price is gauged by seeking minds of earth,
Its value set by chemistry of heart.
Let no vain word be said against this leaf—
The new-green paleness of so frail a thing;
No stronger weapon for the winter's grief
Than sudden tendrils on a bough in spring.
This leaf shall be the pawn on which I'll borrow
To stake my claim of happiness tomorrow.



To use this map hold it before you in a vertical position and turn it until the direction of the compass that you wish to face is at the bottom. Then, below the center of the map, which is the point overhead, will be seen the constellations visible in that part of the heavens. It will not be necessary to turn the map if the direction faced is south. Time given is Standard Time; add one hour for War Time.

The First Point of Aries

By ISABEL M. LEWIS

MANY centuries ago the Zodiac was marked out as a belt encircling the heavens and extending, in width, eight degrees to either side of the ecliptic. This belt defines the path of the earth around the sun, as seen projected against the background of the stars, or the *apparent* path of the sun through the heavens. Within its limits will always be found the sun, moon and planets. It was divided into twelve signs, each thirty degrees in length, one for each month of the year, the sun remaining for approximately a month in each sign. There were also twelve constellations of the Zodiac, one for each sign. Although the constellations were irregular in extent, some large and some small, they corresponded roughly in size to the signs of the Zodiac.

In the days of Hipparchus, about 125 B.C., the signs and constellations of the same name coincided. The first sign of the Zodiac was Aries, and in this sign was the constellation of Aries, The Ram. Then, in order, from west to east, came Taurus, The Bull; Gemini, The Twins; Cancer, The Crab; Leo, The Lion; Virgo, The Virgin; Libra, The Scales; Scorpio, or Scorpius, The Scorpion; Sagittarius, The Archer; Capricornus, The Goat; Aquarius, The Water-bearer; Pisces, The Fishes. The latter constellation lay immediately to the west of Aries, completing the circuit of the heavens.

In the Zodiac, 180 degrees apart, were the points where the ecliptic and the celestial equator, which is directly above the earth's equator, intersected. These were the equinoctial points—the vernal and autumnal equinoxes—where the sun crossed the equator coming north in the spring and going south in the summer. The vernal equinox is the fundamental point of reference in the heavens. It is also called the First Point of Aries, or The First of Aries

ecause at that time, many centuries ago, when the odiac was divided into signs, the constellation of ries was in the sign of Aries, and this sign was hosen to be the first in the Zodiac. Its point of eginning, The First Point of Aries, was the point rom which right ascensions were measured along the elestial equator, and celestial longitudes along the cliptic. It still bears the name The First Point of ries, and the signs of the Zodiac are still counted rom this point of reference, as before, so that the ign of Aries extends eastward from this point a dis-ance of 30 degrees along the odiac. *But the sign no longer oincides with the constellation f the same name.*

In the times of Hipparchus, he First Point of Aries lay in he constellation of Aries near he star Sheratan, or Beta rietis, a third magnitude star n the head of The Ram. Now, bout 2000 years later, at the eginning of spring on March 0, when the sun is at the ver-al equinox, or First of Aries, is no longer in the constella-on of Aries. As a result of The Precession of the Equi-oxes," which is a slow westward ift of the vernal equinox, or oint of intersection of equator nd ecliptic, along the ecliptic, he First of Aries is found in he constellation of Pisces, The ishes, at the beginning of pring in the northern hemisphere. This marks, also, f course, the beginning of fall in the southern emisphere.

The westward shift of the First Point of Aries takes lace at the rate of 50.3 seconds of arc a year. At his rate it takes the vernal equinox about 25,800 ears to make a complete circuit of the zodiacal onstellations and come back to its original position f 2000 years ago in the constellation of Aries. It was lipparchus who first discovered this westward mo-on of the vernal equinox. Apparently the vernal quinox "preceded," or "stepped forward," each ear by a small amount, as if to meet the sun mov-ng eastward, whence came the name Precession of he Equinoxes.

As a result of Precession the north pole of the arth describes a circle of about 23.5 degrees radius round the pole of the ecliptic in the same 25,800-ear period in which the First Point of Aries com-letes its circuit of the zodiacal constellations. Dur-ng this interval of time there is a succession of dif-erent pole-stars as the earth's axis changes gradually he direction in which it points. About 4000 years go Alpha Draconis was the pole-star, and about 14,800 A.D. Vega will be the finest of all pole-stars, although not a close one. Many changes will also take place in the positions of the constellations relative to the equator. About six thousand years ago the Southern Cross was visible in 50° North Latitude as a result of Precession. Even within a period of twenty-five years or so, the position of the equinox among the stars changes so much that atlases or star maps need revision to show the correct positions of the equator and its point of intersection with the ecliptic among the stars.

The present position of this zero point of reference in the heavens is in a region of faint stars in Pisces, and nearly in line with the eastern side of the Great Square in Pegasus. This westward motion of the equinoxes has also changed the positions of the autumnal equinox and the winter and summer solstitial points among the constellations, as well as the position of the First Point of Aries. At the beginning of autumn the sun is now in the constellation of Virgo instead of in Libra, although it is always in the sign of Libra at this time. At the time of the winter solstice it is now in Sagittarius instead of in Capricornus, and at the summer solstice it is in the constellation of Gemini instead of Cancer. Two thousand years from now these same points will have shifted still farther westward. The First Point of Aries will be 30 degrees to the westward of its present position in Pisces and in the constellation of Aquarius. The autumnal equinox will have backed into Leo. Summer will begin with the sun in Taurus, although still in the sign of Cancer; winter will begin with the sun in the sign of Capricornus, but in, or approaching, the constellation of Scorpio. By that time Polaris will have ceased to be the Pole-star, and some star in Cepheus will have taken its place.

The Tropic of Cancer, which marks the farthest distance north reached by the sun at the beginning of summer in the northern hemisphere, and the Tropic of Capricorn, which marks the farthest distance south reached by the sun at the beginning of winter, are named from the signs in which the sun is located at those times.

The signs of the Zodiac were devised centuries ago when astrology was practiced universally, and they were of great convenience and importance to the astrologer, but astronomically they are of little, if any, use. Their symbols are given in our Almanacs, however, and are used in (Continued on page 217)

Fantasy

By JOHN GALLINARI WHIDDING

I circled the tracks of the galaxies
In a chariot, wind-designed,
And winked my eye at the Pleiades
As I left them far behind.

I roughed-and-tumbled the Little Bear;
I whistled the dog-star's name
And tossed him sticks all over the air—
We found it a capital game.

I swept the sky with a sickle-moon,
And gathered a sheaf of stars,
To bribe the dawn when it beat too soon
At the eastern pasture-bars

I stole the Dipper and skimmed the cream
That covered the Milky Way . . .
All this I did in a childhood dream
That fled with the break of day.

The School Page

Edited by E. LAURENCE PALMER

Professor of Rural Education, Cornell University, and Director of Nature Education, The American Nature Association

SHELLING IN PEACE AND IN WAR

IT IS strange how completely time spent in school on science subjects has been monopolized by aspects of our civilization associated with medicine, industry or academic inquiry. I find it difficult to understand why we have so thoroughly neglected the study of shells as a hobby. Even the Science Clubs of America apparently almost completely neglect activities of the hobby type. Interestingly enough, this neglect is not resented by the hobby riders, since they are too happy following their own fields of interest to be much concerned about what others may be doing.

The educational insert in this issue of *Nature Magazine* provides a basis for some introductory studies of the shells to be found along our Pacific Coast. References as to where further helps may be found are provided. It is hoped that, with this stimulus, many schools, particularly those along the Pacific Coast, will begin making and keeping school collections. No doubt many schools will have students and alumni engaged in the war over the Pacific. Many of these could be induced to send home, or bring home, a few of the shells they find here, there and everywhere. Some of these amateur naturalists may write home about the strange birds and mammals they have seen, or about the queer fruits they have eaten, but these things cannot be sent home for the folks to see. Shells can be.

California already has an active club of amateurs interested in shells. They issue mimeographed notes on their activities, which might be taken as a model for other clubs. Those interested in this club should write directly to John Q. Burch, Conchological Club of Southern California, 4206 Hallidale Avenue, Los Angeles 37, California. It is refreshing to read the minutes of this club and notice the variety of activities these people are engaged in, and, particularly, to notice how a club of less than a hundred members must enjoy exchanging experiences. I was particularly delighted with the report of one member, who "drooled at the mouth" when she had to stand by and watch military operations that exposed some splendid material she could not have access to because it was in a "military zone." In the club's notes, we find reports of the travels of the members, and letters they have received from friends in the armed forces who have found interesting shells in various parts of the world. It seems to me that almost any school, with reasonable leadership, could start a similar organization, even though it might be on a smaller scale.

School Shell Collections

Should your school consider starting a shell collection to be built up locally, or to be added to by contributions from globe-trotting alumni, a few things might be worth mentioning. A collection of shells purchased from a tourist stand is, for the most part, hopeless. For example, you can buy, at tourist stands at Niagara Falls, shell souvenirs that must have come from our Gulf coast. They mean nothing except that the purchaser was a sucker. A shell labelled as from some remote place should really be from that place, and if it was collected on the ground by the sender it is just that much more significant. Any shells sent in should then be accompanied by notes giving exact locations. If the exact location of the sender is, of necessity, a "military secret," then the shell sent may be merely numbered, and a code set of numbers giving actual localities can be kept among the effects of the finder and be used when the information can be released with safety.

Most mollusks of course have the shells with animals in them, that is, the best shells are those that have live animals in them when collected. Surf worn shells are ordinarily very inferior. But if you have collected shells with animals in them you know that, in a day or so, such a collection is most unpleasant because of the odor given off by the dead animal. Some recommend that the animal be boiled and softened for removal, but too frequently this destroys some of the most beautiful and distinctive coloration or luster. One of the tricks employed by shellers to clean out shells is to bury the shell in an ant hill and letting the scavenger ants do the work. Another technique consists of piercing the soft part of the animal with a thong and hanging it in such a way that the weight of the shell is constant. If the shell is hung in some remote area, particularly in tropical regions, fly maggots may do the work instead of ants. The bodies of the smaller snails may sometimes be removed by directing a strong but fine stream of water into the shell opening and flushing the whole animal free of its shell. This is particularly successful when dealing with some of the more delicate land shells. Knitting needles and darning needles with hooks on them are sometimes used to probe inside shells and to remove the perishable animals.

Evicting a Conch

Possibly one of the commonest marine shells brought home by tourists is one of the giant conchs, whose shell may be used as a horn. Commonly, the natives drive the animal from these shells by sawing off the tip of the whorl, thus driving the animal from its most sacred retreat. The natives, of course, use the extracted animal for food, but they ruin the shell as a desirable museum object. Schools requesting shells from their alumni might point out these factors as characteristic of good specimens or of bad.

Collections of shells of the bivalves should, of course, be represented by both valves, where this is possible. If broken shells are considered sufficiently important to be sent, then care should be taken to include the hinge, a part that is most commonly used in making identifications. Many of the univalves have the soft animal protected by an operculum after it has withdrawn to the protection of the shell. Naturally, when the animal is destroyed, the operculum is no longer attached to the shell. Where possible, the operculum should be saved and attached in some way to the shell, not only to show that the animal did have an operculum, but to show its nature.

Amateur collectors should be advised to keep their eyes open for the activities of the animals collected, and to record what they see. Particularly useful would be collections of egg masses or of young, if it is possible to identify these with the mature animals. Notes should also record whether the animal was collected from the depths, or from high or low tide lines; whether it was in sand, gravel or mud, or attached loosely or firmly to rocks. Some interesting collections have been made from the stomachs of fishes, where a recent meal had not been destroyed by the digestive activities. In this case, of course, the kind of fish should be noted. Other notes that are worth while include the native names given the different shells, and if there are real or imagined uses these should be noted.

When the shells and the field notes are available for exhibition, or for study, they should be mounted attractively and relatively permanently, to the end that the shell and the appropriate notes will not be separated through carelessness or otherwise. Some of the more beautiful shells may warrant elaborate display. If they are fastened with household cement to clean strips of glass, and if their names or code numbers are then painted in white on the glass, a spectacular effect may be produced by placing the glass over black velvet.

We hear much in time of war of shelling the enemy. Here is a type of shelling that our armed forces may enjoy doing, and which may be considered as shelling the home folks. Not a few of our boys now in military work will continue in that field in time of peace. They may be surprised to know how many of their associates have used shore leave time for the collection

Know Your Stars

Broaden your scope of understanding beyond our little world; reach out for information about the universe; it's interesting and not so very complicated.

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of rare shells for their own collection, or for trade. One major stationed in Alaska has made some important collections that have been offered for sale. He warrants that each shell was collected as a live animal, and while he is not in position to make identifications, since he does not have access to the necessary literature, nevertheless his collections have great value and can be identified by those at home in position to give the necessary help. The major sells his collections with detailed data on the place of collection, and offers to provide the identifications at later dates if this is considered desirable.

Incidentally, *Science* for December 8, 1944, reports that Major Merrill Moore of the U. S. Army Medical Corps, and formerly associate in psychiatry at Harvard Medical School, has been awarded the Bronze Star Medal "for meritorious achievement in connection with military operations against the enemy in the Southwest Pacific." Major Moore was a pioneer in the use of conchology in treating mental disorders. Apparently, he can use shells of one kind in peace and of another kind in war.

The Aleutians

The most recent addition to the splendid War Background Studies published by the Smithsonian Institution is entitled "The Aleutian Islands; Their People and Natural History," and is Number Twenty-one in the series. Collaborators in the preparation of this 131-page booklet are Henry B. Collins, Jr., of the Bureau of American Ethnology, who writes of the islands and their people; Austin H. Clark of the U. S. National Museum, who discusses the animal life of the islands; Egbert H. Walker of the U. S. National Museum, who writes on the plants of the region. In addition to the interesting popular text, the publication contains a helpful bibliography, lists of the mammals, birds and plants of the Aleutians, and keys to the birds and plants found there. Many excellent pictures round out this notably interesting and informative study. Copies are available free on request to members of the armed forces and to others at 25 cents.

Unsung Patriot

Word comes from Paris that Mme. Jean Cotelle, the former Sonia Slobodkin and assistant of Marie Curie, has died from the effects of handling large quantities of radio-active substance. When the Germans were sweeping toward Paris in 1940, Mme. Cotelle, with Professor Debierne, worked in desperate haste to seal the country's precious radium in tubes so that it could be sent to a safe hiding place. She was successful in this, but in so doing hastened her own death.

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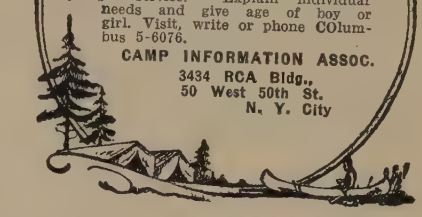

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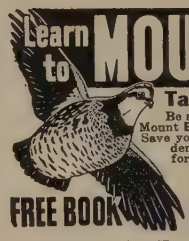

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BORDERS OF THE BOG

(Continued from page 180)

verdant mazes. Suddenly it darted from that rank, leaf-umbrella'd world into rain-wet air and exuberantly claimed a high alder top for song. The fast-flowing melody that poured down with the rain was of that lyric-sweet quality only told by clear water tumbling down white cascades, or jeweled droplets falling musically in crystal caves. Once more to explore the green caverns of his lotus land the water thrush flew, to wade slippery leaf-brims into algae-green water and pick daintily among the floating fairy-paddle greening dark pools. An hour his ringing notes held me in the rain. There is more than adventure—there is beauty in the bog.

PLANTS THAT FOLLOW FIRE

(Continued from page 187)

Chaparral is a cloak of shrubby growth spread thickly over a large area of land—usually sloping land. From a distance it looks like a soft coverlet, but the intruder finds himself torn and scratched by stiff and sometimes thorny branches. It is said that chaparral land was once forest-covered, and that repeated fires have resulted in the present bushy formation. The three genera most abundantly represented in chaparral are *Ceanothus* (wild lilac), *Arctostaphylos* (manzanita) and *Adenostoma* (chamise). One stand of chaparral may be composed of a single species, or of several species from two or more genera. These are usually shrubs that, after going through years of repeated burnings, have developed platform-like rootcrowns from which fresh sprouts come after each fire.

There may be a mile or more of just one species belonging to one of these genera. In northern California there is an almost pure 3000-acre stand of *Ceanothus thyrsiflorus,* and at higher altitudes mountain trails lead for miles through a two-to-three-foot blanket of *Arctostaphylos patula.* When these areas are revisited by fire, and the tops burned from the shrubs, myriad unexpected annuals and perennials may spring up and prosper until overpowered by the old shrubby inhabitants. The tall scarlet-flowered perennial, wild larkspur, *Delphinium cardinale,* of southern California grows at the edge of chaparral. It is a strong energetic plant and a profuse and gaudy bloomer, but the year after fire it attains exaggerated proportions. In July, when an acre or so of foothill is enveloped in fiery blossoms, the terrain looks as though it had been visited a second year in succession by a surge of shooting flames.

From the many fire-follower notes in my files I select these memoranda from a list numbering more than seventy-five species that were spreading luminous bloom across one flame-ravaged tract. This record was made in southern California, six months after the first rain had come to renew the growth from old rootcrowns and germinate long dormant seeds. It gives an idea of the rapidity of recovery. *Ceanothus spinosus,* four feet; toyon (California holly), five feet; *Arctostaphylos bicolor,* four feet; *Lonicera* (honeysuckle), five feet; *Adenostema sparsifolium,* four feet. All these were from old roots. *Penstemon centranthifolius,* three feet; *Eriogonum fasciculatum* (buckwheat), eighteen inches; *Asclepias californica* (milkweed), ten inches—all from seedlings. One *Ceanothus crassifolius* seedling of seven inches had a root two feet long.

From a distance a burned area is as forlorn a sight as one might expect to see, but after gentle early winter rains, a closer view reveals a gathering of resplendent young growth bearing a look of complacent contentment seldom observed among other plant communities. Nature has come once more to the rescue. Annuals and perennials are safely entrenched and their seed will soon be sown. Shrubs have resprouted. The land is saved from erosion. Another cycle is well under way and all is now well—until the next burn.

TAMPALA, GARDEN IMMIGRANT

(Continued from page 211)

ailing. Because of its tenderness and entire lack of coarse fiber, it may find an important place in the diet of people with delicate digestive systems, and for infants and children. Fortunately, most children like it. Some tests have already been made with people who have not been able to eat other greens, or only pureed food, and with good results. Clinical observations over wider fields are being carried on. Complimentary reports have come from food experts, garden specialists and test kitchens. Tampala offers, it has been proved, a rich source of vitamins, the red variety having double the vitamin A content of spinach. Its entire lack of objectionable tastes, coarseness of fiber, together with its long period of usefulness, good shipping quality, and the ease with which it is prepared, promise a real future with home and market gardener and the canner for tampala, garden immigrant.

"Cloth of Gold"

When we were preparing for publication Gertrude M. Weber's article, "The Spell of the Shell," published in our February, 1945 issue, the manuscript was rather longer than the space available permitted. In her story of the lure of shell collecting there was, however, one part that seemed worthy of saving and printing by itself. It was the fairy story that is wound about the Prickly Pen Shell and its strong silken cord, or byssus, by which it anchors itself to rocks at the bottom of the sea. It is from this thread that the fine textile known as "cloth of gold" is woven. This story, in Miss Weber's words, is as follows:

"There was once a beautiful princess who had three suitors. All were of noble birth and princely mien. Each was favored by nature and grace with all that is comely and admirable in man. Each prince was madly in love with the fair princess, and each wooed her and wanted her for his own.

"Poor princess—she was not sure of her own heart, and did not know which of her lovers to choose. One day, as she was sitting in her castle tower, dreaming of the future and wondering how she could ever decide, she found herself idly twirling the little gold ring on her finger. Suddenly, an inspiration came to her, and, calling her lovers, she told them that the one who would bring her a scarf which would slip through her ring, would be the one whom she would wed.

"Now it happened that two of the princes were fabulously wealthy and commanded great kingdoms, and so they went over all their domain and out into the wide world in search of the finest and daintiest materials they could find. One of them found a scarf made of wool, so soft and light that he could not feel the weight of it in his hands. 'Ah!' thought he, 'no one has ever seen a finer scarf than this. I will surely win the fair princess.'

"Now the second prince traveled to the far eastern countries, where the finest silks were known to be spun, and there he found a scarf of so fine and dainty a texture, that, for sheer loveliness, it surpassed anything that he had ever seen, even at the most splendid courts of the world.

"'Ah!' he said to his faithful courtiers, who had accompanied him, 'no one will be able to find a scarf to match this if he travels the whole world over. I will surely win the fair princess.'

"But the third prince, whose little kingdom bordered the sea, and whose lowly subjects loved and honored him, but could not pay him much material tribute, went down to the seashore and sat down and pondered. He had no gold to take him over the wide world in search of the loveliest and daintiest scarf for his beloved, and if he did find it, he knew he had not the wherewithal to purchase it. And, as he sat there in pensive mood, he picked up a shell lying at his feet. Attached to the shell were fine, silky threads. The prince ran his fingers lightly through the strong, slender threads. 'If I could get a scarf of material like this,' he thought, 'I think it would be fit for the fairest queen.'

"So he gathered all the strands of the golden-threaded byssus that he could find, and took them to his old queen grandmother, who wove them into a scarf for her grandson, whom she loved dearly.

"Then the great day came at last, the day appointed for the lovers to meet at the castle of the fair princess. Each prince presented to her the scarf he had procured for her.

"The princess shook open the white wool scarf and felt lovingly of its soft, fluffy texture. It billowed away in the soft breeze and looked like the daintiest of white clouds that sail across the blue on a mild June day. Her eyes shone as she inserted one corner of the scarf through her little gold ring, but alas, the scarf stuck. It was not fine enough to slip through.

"Then she took the scarf of silk, brought by the second prince from the far away Orient. It rippled down in crimson beauty, so delicate and lovely, that again the eyes of the princess sparkled as she inserted an end through her ring. Crestfallen, she handed the scarf back to her wooer. It would not go through.

"Now she took the scarf that the poor prince had brought her. She opened it and it fell in cascades of gossamer daintiness, so fine and supple were the delicate threads. It caught the sunlight and reflected the rays so that it looked like cloth of burnished gold. A great sigh of admiration went up from all the ladies-in-waiting, and then not a sound was heard, as, with hands that trembled, the fair princess inserted the scarf in her ring. It slipped through so easily that it scarcely touched the edge of the little gold band.

"The princess looked up and found herself smiling into the most beautiful eyes she had ever seen, and she knew that she had made no mistake. And so the fair princess married the prince who had brought her the scarf made of 'cloth of gold' and they lived happily ever after."

THE FIRST POINT OF ARIES

(Continued from page 213)

connection with the dates of the beginning of the various seasons to indicate the sign into which the sun is then passing. The symbol for Aries is the familiar one, supposed to resemble the head of a Ram. This is also used to indicate the position of the First Point of Aries, or vernal equinox.

In early April there will still be an opportunity to observe Mercury in the very favorable position that it held the last of March in the evening sky near eastern elongation, but it will soon be lost to view in the twilight as it draws in rapidly toward the sun and inferior conjunction with it on April 13. It then enters the morning sky, where it will be poorly placed for observation for some time.

Venus is now rapidly approaching the sun, and will be at inferior conjunction with it on April 15. It may be seen in the evening twilight early in the month, and by the end of April, after passing to the morning sky, will rise about an hour before the sun. It will be in conjunction with Mercury on April 26.

Mars is in the morning sky, passing from Aquarius into Pisces at the end of the month, but is poorly placed for observation.

Jupiter is now in the southeastern sky at sunset in Leo, and is in fine position for observation throughout the month.

Saturn is in Gemini, and is high above the western horizon at sunset, in fine position for observation in the early evening.

The swiftly darting Lyrids, a periodic shower of meteors, should be seen in the early morning hours coming, as their name indicates, from the general direction of Lyra, and its bright star, Vega, April 20 to 22.

Exchange Rocks

Geneal Bosworth, care of W. L. Bosworth, Treasureton, Idaho, would like to exchange rock and mineral specimens with other young people interested in this field. She lives near lava craters and finds many interesting rock formations in the nearby hills, so is in a strategic position to exchange specimens. She is particularly interested in obtaining some specimens of puddingstone.

Butterflies and Moths

Kenneth Baker, 113 Naples Street, Corpus Christi, Texas, is a student of butterflies and moths, and a collector who would like to correspond and trade with others similarly interested.

New World's New Crops

War proved what dangerous problems can arise from dependence on far-away and concentrated sources of supply of various essential products. It emphasized the importance of more certain sources in our own hemisphere. It also gave great impetus to development of the possibilities inherent in the other countries of the Americas, particularly that area known as Middle America. In January, 1945, *The Atlantic Monthly* published an interesting and important article entitled "New Crops for the New World," by Samuel Zemurray and John Terry. It has been reprinted and is available from The Middle America Information Bureau, Station Y, Box 93, New York 21, New York.

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WOLFFIELLA FLORIDANA

SPIRODELA POLYRHIZA

LEMNA MINOR

WOLFFIA SPECIES

LEMNA TRICUSPA

Range maps showing the distribution of these tiny flowering plants. Darker shading shows the principal range; lighter shading the uncertain range. Isolated records indicated by dots.

THE WORLD'S TINIEST FLOWERING PLANTS

(Continued from page 204)

substances in much greater proportion than the water in which it grows. In one test, *Lemna* contained four times the amount of potassium and of phosphoric acid than was obtained by evaporating an equivalent weight of the water.

The duckweed's tremendous reproductive powers, vigor, and vitality serve indoor aquaria and outdoor water areas well. If it is introduced into a pond or aquarium so foul with organic decomposition that other plants simply cannot survive, the duckweeds, if given plenty of sunlight, will purify the water in a surprisingly short period of time.

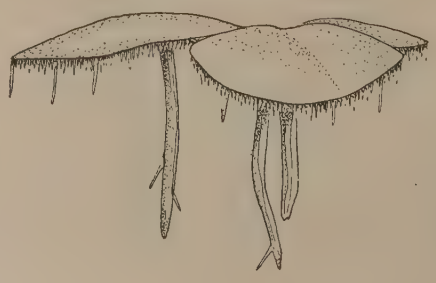
Those who have seen the rare flowers of the Lemnaceae say that they consist merely of modified leaves called spathes, each of which encloses two male flower parts represented by two anthers and a filament. The female flower is equally simple, consisting merely of a stigma, style, and ovule.

Owing to the scanty production of pollen on the part of the male flower, and to the tiny reproductive organs of the female flower, Agnes Arber, the author of *Aquatic Plants*, believes that pollination is made possible by insects rather than by the agency of the wind. If pollination is successful, the seeds produced may germinate as soon as they ripen during the summer. Sometimes they germinate while still attached to the parent plant. In other cases, the seeds may lie dormant through the winter and wait until spring before developing into a new plant.

As the autumnal days approach, with their shortened periods of sunlight, the young duckweeds born out of the old mother plant produce and accumulate an increasing amount of starch. Later, the plants of autumn birth have smaller and smaller air chambers, making them less buoyant. Gradually, the old buoyant plants die away and their place is taken by the new denser ones. Finally, late in the fall, the youngest plants become so dense with starch and so free of air spaces that they slowly sink to the bottom where they remain in a state of suspended animation through the winter. By this means, the plants escape the ice that forms on the surface of the pond.

In the spring, new fronds begin to grow out of the submerged plants. The young plants utilize the starch food of their parent. As they continue their growth, they develop into plants with large air spaces, and, at the same time, the amount of starch of the parental stock is lessened. Eventually the whole plant group, parents and their many offspring, is lightened and rises to the surface for another season of rapid growth and multiplication. Soon the many colonies spread quickly, renewing the pond's fresh green duckweed carpet.

Top and side views of a *Lemna minor* raft, greatly enlarged. Drawings by Donn Rosen.



ODD BEDFELLOWS AND THE WOOD FROG'S WEDDING

(Continued from page 183)

ligence. The wood frog male under the influence of spring is almost nondistractable. The one public function he attends temporarily shuts out all other interests. But, as shown by his clasping my finger, he is a blunderer. For a moment he may grip a last year's cattail stalk or, as often happens, another male. Not the latter's quacks and efforts to break away, but the disappointing absence of a certain firm rotundity as of a gravid female, impels him finally to loose his hold to go on seeking blindly elsewhere.

This spring I found a gravid female spotted salamander, half dead from the unwelcome attentions of six or seven wood frogs. Rescue came too late. She must have been injured internally from frenzied clutching, for in a safe aquarium she grew rapidly enormous with gas till I had to finish her lest she burst.

The wood frogs' wedding winds up with enough eggs laid correctly to ensure an ample crop of tadpoles soon to swim. The frogs, all passion spent, turn to a life of leisure on the forest floor, tempestuous times behind them. No, all is not idyllic charm and sheer perfection in the woodland ponds in spring, although the drama that Thoreau most surely witnessed there is as important as the actors' lines that he transcribed. Act I at last is ended; Act I of the four-act play entitled "Spring, Summer, Fall, and Winter." Nature shifts the scene, more certain of a successful second act than even the great Aristophanes could ever be. But the wood frogs in the cast will not be back until, in its never-ending run, the drama is repeated.

Swedish Films

Thirteen motion picture films, three in color, are available, for showing in schools, churches, and before clubs, from the Swedish Travel Bureau, 630 Fifth Avenue, New York 20, New York. The most recent addition to this series is a sixteen-millimeter film showing a colorful and adventurous visit to Swedish Lapland, with its vast reindeer herds, its snow-peaked mountains, wildlife and roaring waterfalls. A booklet describing the films and indicating the basis on which they are available may be obtained from the above address.

Field Reelected

At the annual meeting of the Chicago Museum of Natural History, Stanley Field was reelected president by the board of trustees and thus began his thirty-seventh consecutive year in this post. All other officers who served with him in 1944 were continued in office.

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Postwar Highways

Many of the highways planned for postwar construction will be limited-access roads, often called freeways or throughways. This means that, in the interests of free and safe flow of traffic, entrances to the highways will be far apart, there will be no grade crossings, and roadside business will be eliminated. Thus these highways have the potential beauty of parkways, and the ribbon slums that have ruined so many highways of today will not exist.

This potential cannot, however, be realized unless one form of structure, which does not depend upon access to the highway, is eliminated. This is the billboard. That the outdoor advertising industry does not intend to allow these throughways to escape billboard "adornment" is indicated by the fight made with respect to a 468-mile throughway planned by New York State through the scenic valleys of the Hudson and Mohawk Rivers and along the south shore of Lake Erie. The State-introduced bill for the highway provided that no advertising signs could be erected within 500 feet of the right-of-way. The lobby of the billboard industry had this restriction removed before the bill became law.

To meet this menace the National Roadside Council urges protection, by state law, of all postwar limited-access roads, banning billboards from the highway environs. The legislation would apply only to such roads, and would affect only new roads to be constructed. The billboard industry could not cry discrimination since the law would merely extend the restriction that affects all other business to include the billboards.

There is an ample body of judicial opinion to support such laws. The Vermont Supreme Court, for example, has declared that billboards along the highways hold their position not by right but by sufferance; that a state or municipality may restrict, or even prohibit, highway advertising without depriving either the property owner or the billboard owner of any constitutional rights.

It seems unthinkable that the taxpayer, who will provide the many, many millions to build these highways, will consent to their being parasitized by the outdoor advertising industry. The way to be sure that this does not happen is to see that the state highway commissions know just how the people, who pay for and are going to use the highways, feel.

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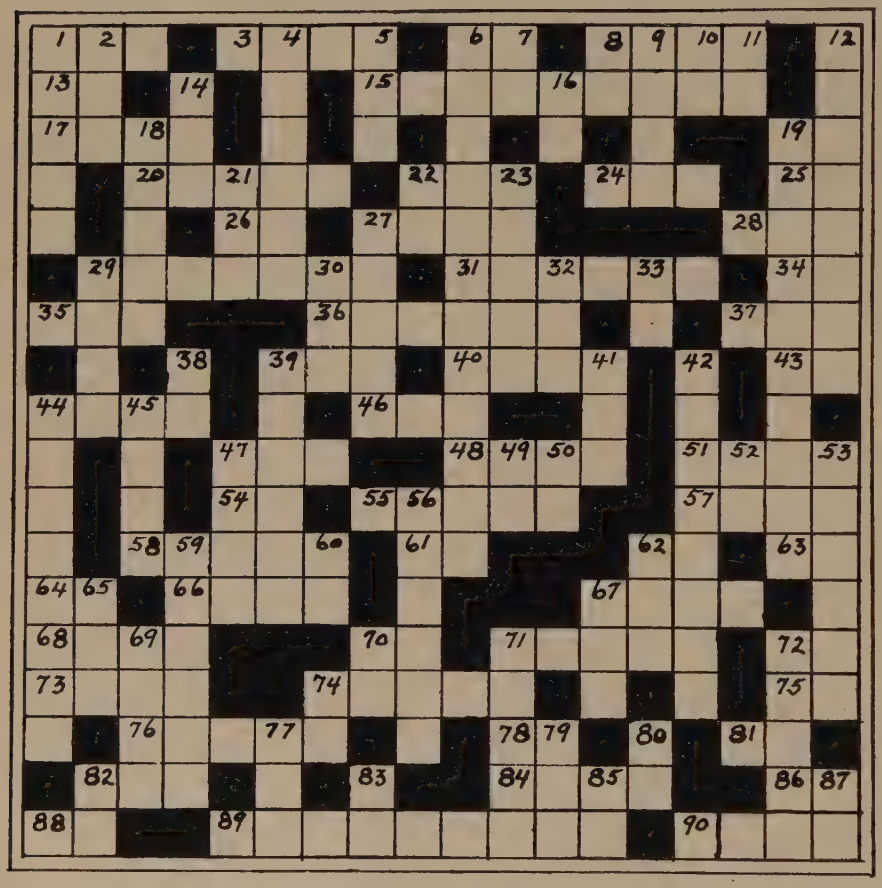
A CROSSWORD PUZZLE WITH A PURPOSE

MISS M. BLANCHE COCHRAN is a teacher of biology at the Scott Senior High School in Coatesville, Pa. In her class work she has made effective use of crossword puzzles based on various phases of biology—Protozoa, Annelids, Mollusca, etc. She has found that they stimulate interest in an educational hobby; aid in "fixing" biological terms; provide a quiz on vocabulary; supply leisure activity; stimulate final review; improve spelling and accuracy; broaden trend of thought, since a word may have several meanings; stimulate activity on "off days," such as the day before or following a vacation.

What Miss Cochran, and *Nature Magazine,* are interested to discover is whether science teachers regard such a device as useful. Miss Cochran plans a book containing between forty and fifty such biological puzzles if they appear to serve a purpose. Miss Cochran and *Nature Magazine* would appreciate the opinion of teachers and other readers. Any criticism or comment should be sent to Miss M. Blanche Cochran, Nature Magazine, 1214 16th St., N.W., Washington 6, D. C.

Below is one of the crossword puzzle series, this one on Mollusca. The solution of the puzzle will be published next month.



ACROSS

1. Heights (abbr.)
3. Smallest rings of growth
6. Symbol for lead
8. Stew
13. Adult corn worm
15. Common name for mollusks
17. Olfactory organ
19. South America
20. Unpleasant sound
22. Contraction of "it is"
24. Chief habitat of mollusks
25. Credit
26. Prefix
27. For locomotion
28. Royal Air Force
29. Having 2 shells
31. For food-getting or excretion
34. Six
35. Elongated fish
36. Secretes the shell
37. Nickname for Lester
38. Ten
39. Hole
40. 20 quires of paper
43. New Hampshire
44. United States Marine Corps
46. Salt water
47. Month mollusks begin egg-laying
48. Valuable mollusk for food
51. Enemies
54. Conjunction
55. Entrance to short esophagus
57. Through
58. Organs for respiration
61. Men's organization
62. United Brethren
63. Sergeant Major
64. Bachelor of Arts
66. For protection of young birds
67. For nourishment
68. A popular picture magazine
70. Preposition
71. Deep sea mollusk
72. Southeast
73. Large trucks for moving purposes
74. Of considerable value in mollusks
75. Pair
76. A mark to denote an insertion
78. Plural pronoun
81. Georgia
82. Second (abbr.)
83. 500
84. Pearls
86. Plural pronoun
88. Boy's name
89. Habitat of many mollusks
90. Habitat of a few mollusks

DOWN

1. Place about which shell opens and closes
2. Adverb
4. Lives in fresh water also
5. First name of famous explorer
6. Outer layer of shell
7. Bachelor of law
8. Preposition
9. Middle layer of shell
10. Form of "to be"
11. Exclamation
12. Mollusk enemy
14. An old make of auto
16. Lieutenant
18. A univalve
19. Another value of mollusks
21. Boy's name
22. Preposition
23. Platform for getting over a fence
27. Exploits
29. Large quantities of oysters
30. Virginia Military Institute
32. A vegetable (sing.)
33. Conjunction
38. 90
39. Jewelry from some mollusks
41. Miriam's nickname
42. Characteristic of mollusks
44. Having shell in one piece
45. Marjorie's nickname
47. Subterranean insectivorous mammal
49. Lieutenant
50. Exclamation
52. Another exclamation
53. Season not to eat mollusks
56. Food mollusk
59. For protection in some (2 words)
60. Saint
62. I owe you (reverse order)
65. Type of reptile
67. Valuable mammal skin
69. One time
70. Exclamation
71. Garden pests (Mollusca)
72. Eggs
74. Street
77. A structure on some univalves
79. To determine in advance
80. Plural pronoun
82. South Dakota
83. District of Columbia
85. Master of Science
87. Boy's nickname

Bark Beetle Damage

Bark beetles cause greater yearly damage to certain types of forests than do forest fires, the U. S. Department of Agriculture reports. At present, a bark beetle outbreak is devastating the Engelmann spruce forest of the central Rocky Mountain region. More than 250 million board feet of high-value spruce timber has been killed during the past two years, according to estimates. This means that bark beetles have destroyed, in this region alone, enough wood to build more than two thousand homes of average size.

Garden Education

Garden Graphs, two integrated courses in garden education, have increased importance in these days of Victory Gardens. Prepared by Paul R. Young, Supervisor of School Gardening in Cleveland, Ohio, these courses are divided between elementary material and advanced study. Teachers' manuals are provided for each course. Sample sets of the four books are available from Garden Review, Inc., 415 Lexington Avenue, New York 17, New York, at one dollar for the set. Special prices are made for quantity orders.

Under the Microscope

By JULIAN D. CORRINGTON

ROOTS

THE PHOTOMICROGRAPHS FROM SLIDES COURTESY OF WARD'S NATURAL SCIENCE ESTABLISHMENT.

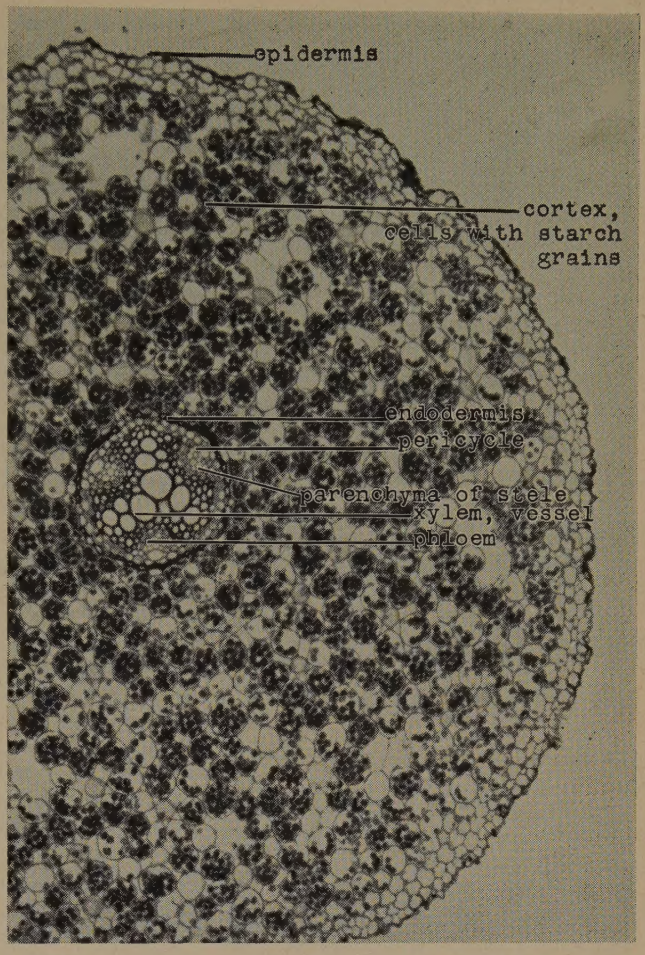
THE return of spring always heralds the appearance of the four b's—bards, bees, birds, and blossoms—and prompts an annual urge in this Department to turn from the laboratory to outdoor subjects. Botany is an inevitable science to claim one's attention when the plant world awakens from its long sleep and sap begins its ascent from winter storage in roots.

The root is a logical structure with which to begin any discussion of plant anatomy and physiology, and the microscopist who sections this organ, stains the sections according to the safranin—fast green technique, and mounts several of his best preparations as permanent slides, has before him the factual material for an understanding of many of the basic processes in the web of life.

True roots occur only in higher plants: pteridophytes, the ferns, horsetails, and clubmosses; and spermatophytes, or seed plants. To qualify as a root, the plant part must include fibrovascular bundles—that is, conducting tissue in the form of vessels—continuous with those of the stem, but which cannot bear buds or shoots, as does the stem. Analogous organs in mosses and other lower plants may serve some of the functions of true roots, but do not have a vascular construction; they are termed rhizoids (root-like). Likewise rhizomes, corms, and bulbs, although growing underground, are actually stems, not roots, since they bear buds. Roots characteristically occur beneath the soil surface, but this condition cannot be made a part of a definition, contrary to what one would think at first, since there are numerous plants with aerial roots, including many orchids that grow high up on stems and branches of trees as epiphytes. Their roots hang down and are constructed to retain dew and rain. Some of these roots even possess chlorophyll, and, in species without leaves, manufacture all of the food used by the plant.

Typically, the root system of a plant begins as the seed

Older woody root of basswood, showing annual rings; 15 X.



Part of cross section of buttercup root. This is the herbaceous type, showing primary tissues; 100 X.

germinates, growing downward by the pull of gravity from the radicle, or lower end of the seed stem, the hypocotyl. Two main types occur. If there is a single main root, giving off many secondary branches, it is termed the tap root, and the plant has a tap-root system, as in pine. If there is no single dominant root but numerous downgrowths of more of less equivalent size and importance, the plant has a fibrous-root system, as in grass. A tap root that becomes greatly enlarged for food storage is seen in the carrot, while fascicled roots are similar clusters of tuber-like enlargements in a fibrous system, as in the dahlia.

In some plants, roots may be produced later from any of several lower nodes of the stem, and even from branches and leaves, as well as artificially from cuttings. These are adventitious roots, conspicuous in corn and banyan. The chief functions of roots are anchorage and support, absorption of water and mineral salts, transportation of these absorbed materials upward to the stem and, often, storage of reserve foods.

Roots give off branches repeatedly, growing downward as the shoot grows upward, the extent of the average plant below ground keeping pace with or exceeding that above. One recent investigation of the root system of a single rye plant gave the total number of roots as more than 13 million, with a combined length of 387 miles and a total surface area of 2554 square feet! These figures are far in excess of all visible parts of this same plant.

The advancing part of any root is the root tip, slender and delicate, generally protected by a thimble-like root cap, pushed ahead of it like a shield. Cells at the root tip are small, angular, closely packed, with dense protoplasm, and all alike. They constitute an embryonic tissue, known in plants as meristem, and their role is to grow and differentiate into the specialized parts of the developed root. This is the region of active cell division, well known to all students of biology as the most

A single root hair of barley; 800 X.

widely-used preparation for the elementary study of mitosis (this Department, Nov., Dec., 1942). Many of these cell divisions produce more meristem, which keeps advancing deeper or farther into the soil, always at the tip of previously formed parts of the root. Behind this zone is the region of cell elongation, cells resulting from recent mitoses undergoing enlargement, chiefly longitudinally. The protoplasm does not keep pace as to increased volume with that of the cell walls; a large vacuole appears in the center of each cell, forcing the living protoplasm to the periphery. Still farther back is the region of cell maturation, or, as frequently termed, of cell differentiation, where root hairs appear on the outside and the stele (pronounced steélee) centrally. This growth process may be likened to the progression of a paving machine. The raw materials—sand, gravel, cement, and water—are poured into the machine's reservoir and there mixed into a formless meristem. As the apparatus advances, it pays out finished pavement behind it. In the root, as the meristem advances, it pays out formed structures behind it, such as xylem vessels and endodermis.

Root hairs are lateral projections from single epidermal cells, and occur over a zone beginning a few millimeters back from the root tip, extending usually only a few millimeters up the root, although, as in winter wheat, they may cover a distance of two or three feet. For study or mounting, root hairs are best obtained by placing some radish seeds between pieces of wet blotting paper, preferably black in color to contrast with the white root tip and hairs. These will form speedily as the seed germinates, especially if kept warmed in a low-temperature incubator or germinating box.

New root hairs are continually being formed at the growing end of the root, and old ones are dying off at the stem end. They cling tightly to soil particles, but are not stripped off by growth of the root, since the region of root hairs does not advance; only the root tip grows in length. But because their place of formation is just back of this moving tip, and since new hairs form and old ones die off, the belt of root hairs is constantly advancing, like a caterpillar tractor, into fresh areas of soil, hence always with new fields to conquer in the unending quest for water and minerals, the life of the plant depending on the success of this search. A single root hair lives only a few days or weeks, or, at the extreme, in some trees and other plants, a few months.

A root hair begins as a tubular outpocketing from the lateral surface of an epidermal cell and is not a separate cell itself. As it grows, the nucleus and most of the protoplast flow out into the hair tube. This structure, usually about half an inch long when fully formed, is the principal absorbing agent of the plant, and must be withdrawn intact, together with surrounding soil particles, in transplanting. If any considerable number of the total quantity of root hairs are stripped off in this operation, the plant will wither and die.

The stele is the central cylinder of roots and stems, and contains the vascular tissue in all cases, and woody tissue where such is present. In cross sections of young roots, the outermost row of cells constitutes the epidermis. This is followed by a wide zone of cortex, consisting of many rows of undifferentiated cells of the nature of a filler tissue, termed the parenchyma, and then a single row of endodermal cells, with a thin wall facing the cortex, but a greatly thickened wall on the other sides. This construction is interpreted by some as constituting a water-tight jacket around the stele, which begins just inside the endodermis.

The first layer of cells in the stele is the pericycle, then come alternating areas of xylem (zy′-lem) and phloem (flow′-em), with interspersed parenchyma cells. Some roots have a central pith, others do not. The xylem stains red with safranin because these vessels are heavily infiltrated with lignin. The phloem stains green, in the safranin—fast green technique. The xylem, often star-shaped at first, consists of thick-walled tubes of varying sizes, many of them very large, looking like huge holes in the tissue. The phloem is also made of tubes, but thin-walled and much smaller, about the same diameter as the surrounding parenchyma cells. The xylem conducts water and its dissolved minerals, and, in the spring, the sap or stored food, upward to the stem. The phloem carries food products downward from the leaves and

"Oh, she's OLD! Almost thirty!"

At twenty, thirty seems ancient.

At thirty, forty is distant middle age.

At forty, well, it'll be a long time before you're fifty.

The point is that ten years *ahead* always seems like a long time. Yet, actually it passes "before you know it". . . and you find yourself face to face with problems, opportunities, needs, that once seemed very far in the future.

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AMERICAN NATURE ASSOCIATION

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em, to nourish all of the root cells and for storage of any xcess amount. The xylem consists of elongate hollow cells, ointed at each end and termed tracheids, or end-to-end hook-ps of long, hollow cells, producing dead structures called essels. The phloem is made up of sieve tubes and companion ells.

Absorption by the root hairs occurs by osmosis (this De-artment, June-July, 1944), or, according to some, by a soak-ng-up process termed imbibition. The water is passed on from ell to cell through the cortex and its intercellular spaces, and ience through the endodermis and pericycle into the xylem ibes, up the root to the stem and leaves. A very considerable oot pressure is developed, which plays its part in the ascent f sap. The cells of the pericycle retain the embryonic power f division and differentiation, as it is this layer that produces ranch roots. These must push their way out through endo-ermis, cortex, and epidermis to reach the exterior.

This completes the story for many classes of roots, especially ose of monocotyledons. All of the parts thus far discussed re classed as primary tissues, and roots with only these do not row in girth. In perennials, however, as in gymnosperms and icotyledonous herbs, shrubs, and trees, secondary tissues per-itting an increase in diameter make their appearance. Some f the parenchyma cells, between the xylem and phloem in the ele, become another type of meristem, the cambium, whose ells undergo division and differentiation, producing secondary ylem on the inside and secondary phloem on the outside.

Another secondary meristem is the cork cambium or phel-ogen, derived from the pericycle or from cells in the cortex. xpanding girth ruptures the original epidermis and cortex, hich slough off, but the phellogen forms a smooth external ayer of dark-colored cork, older roots thus coming to re-emble branches of trees. Annual rings of wood appear in roots f woody perennials; a cross section of such a root looks much ke that of the stem. In those plants in which the cork cam-ium is produced by the pericycle, the entire older root is ne stele, all outer parts gradually disappearing. The abundant oody tissues add a great deal of strength to tree roots in their nction of support for the superstructure above ground.

A great tree root is, then, a vastly ramifying and complex rgan. Near the trunk it may rival the largest branches in di-meter, and comprise a heavy bark that surrounds many zones f successive yearly growth, with conducting vessels and sup-orting wood. As it courses outward and downward from the runk, it gives off an enormous number of branches, each ivision becoming smaller in girth, tapering to a distant end, ith an impressive mileage when all are added together, and ith millions of absorbing root hairs, always advancing into esh territory. No wonder man has found the subject a rich ne from which to draw simile and metaphor—our customs are eeply rooted in tradition, and while in times like these whole opulations are uprooted, the man of action gets to the root f the matter, and discovers that money is the root of all evil.

TRADE NOTES

One of the most perfectly organized textbooks in any of the iological sciences is *Fundamentals of Bacteriology,* by Dr. Martin Frobisher, Jr., of The Johns Hopkins University. We ere accordingly pleased to receive a copy of the new third dition for review, and to find that it exceeded our expecta-ons. The entire book has been reset, brought thoroughly up date, and provided with some sixty new illustrations, in-uding several in full color. In his revision, Dr. Frobisher has dopted a functional instead of a taxonomic approach, and has ncentrated on unity to eliminate repetitions. Nomenclature as been reconstructed, but there are new chapters, or much ew material on many of the groups of bacteria, on yeasts, olds, and viruses, as well as on the electron microscope, uorescence microscopy, penicillin and gramicidin, home food reservation, the chemistry of bacterial growth, the mechanism disinfection and sterilization, and cultivation of micro-rganisms in chick embryos.

This is a splendidly written and beautifully illustrated and printed general text, suitable for the individual microscopist as well as for the classroom. Opening the book at random and starting to read, anyone with a slant toward scientific literature will find it difficult to put the volume down again, and this is certainly one of the tests of good writing. A first edition of the size and lavishness of this third one would cost twice the price. Pp. xvi, 824; colored frontis., 398 figs. W. B. Saunders Co., West Washington Square, Philadelphia 5, 1944. $4.00.

Readily adaptable for use with Frobisher's as well as with other textbooks of bacteriology is the *Laboratory Manual for General Bacteriology,* by the Department of Bacteriology and Immunology of the University of Minnesota. This is an 8 x 10½ inch, wire-bound, printed manual, with general instructions, twenty-nine exercises, work sheets for diagnoses of unknowns, and an appendix of formulas for reagents, stains, and media. By use of these very well written exercises, the student learns bacterial types, microscopy, staining, preparation of media, culturing, various tests; he works with pathogens, saprophytes, molds, yeasts; and studies the bacteriology of soils and milk. The manual is modern and has been tested and revised for a number of years before this publication. It is suitable for a one-quarter or one-semester course and is sufficiently flexible in content to permit adjustment to local conditions. Pp. vi, 54. W. B. Saunders Co., West Washington Square, Philadelphia 5, 1945. $1.00.

TOOTH SUCCESSION

The accompanying photomicrograph showing the permanent incisor of a human infant two and one-half years old developing below its predecessor of the milk set was scheduled for inclusion in this department in January, with the article on teeth, but did not arrive in time. Owing to its excellence as a picture and its importance to an understanding of the subject, we are running it under a better-late-than-never policy. The slide is by courtesy of Dr. Schauer of the University of Illinois School of Dentistry.

BEGINNER'S PRIMER

To many entomologists, amateur and professional alike, and certainly to the general public, the great Order Lepidoptera holds first place in interest among insect groups. It is exceeded in number of species only by the Coleoptera and Hymenoptera, and ranks among the highest of all animal divisions as an arch enemy to human interests. In this order one meets the gypsy and brown-tail moths, European imports that destroy our fruit, shade, and forest trees; the codling moth and canker worms that cause apple growers sleepless nights; the leaf-cutters, leaf-miners, leaf-rollers, twig-borers, corn-borers, girdlers, tent caterpillars, webworms, bollworms, tomato worms, tobacco-worms, army worms, cutworms, the flour- and meal-moths and, finally, those villainous household pests, the clothes moths. These are but the more outstanding of innumerable species that ruin property running into billions of dollars annually the world over, and force the farmer to tremendous expenditure of time and money in waging a ceaseless warfare to prevent, as far as possible, their constant depredations.

On the other side of the ledger, this order includes the silk moths, exceeded in value among domesticated insects only by the honey bee. Of indirect but no less real benefit, the literary, artistic, and esthetic contributions cannot be overlooked. The Greek name for butterfly is psyche, the soul, symbol of immortality; the allusions to gayety, gaudy attire, the life of unsubstantial trifling, or sprightliness, refer to the butterfly, usually in contrast to the sober and industrious ant; the moth and the flame is an age-old motif, as is the beautiful creature emerging from the drab chrysalis. A large number of classical names are commemorated among the genera of butterflies, as Pieris, Junonia, Parnassius.

Nearly everyone derives pleasure in observing butterflies and the larger, showier moths; their forms and flight are the embodiment of grace while their beauty of color and design is emblematic. Collections of these insects carry a considerable appeal to the average observer and constitute one of the most popular of Nature study hobbies. Personally we find the beetles more interesting due to their far greater variability in adaptation to more diverse modes of life; others lean toward the Hymenoptera from social and psychological aspects; but by and large the popular vote would go to the Lepidoptera, the moths, skippers, and butterflies.

The adults of members of this order are from medium to large in size as insect dimensions go; in fact, considering wing spread rather than length or body bulk, certain moths, as the Hercules Moth of Australia, with a wing expanse of 10½ inches, are the world's largest insects. The word Lepidoptera is from the Greek for scale-wings, and designates one of the most prominent characteristics of the order; not only the wings but also the bodies and appendages are usually completely covered with fine hair and complexly sculptured microscopic scales that are flat and overlapping. When handled, these scales come away easily, showing as a fine dust on the fingers; hence these insects cannot be captured with the hands if perfect specimens are wanted for mounting.

The mouthparts are formed for sucking and are mainly made of the highly modified maxillae, which are greatly elongated and pressed together to form a suction tube, the proboscis, carried coiled under the head like a watchspring when not in use but capable of extension, sometimes to as much as 20 inches in certain species. The tip of this organ may be armed with minute denticles to lacerate plant tissues and set free the desired juices. The compound eyes are large, the ocelli two or absent; antennae various, from clavate or serrate to hooked or knobbed and often plumose in males. The wings are nearly always large and of two pairs, forewings generally larger than hindwings, with many longitudinal but few cross veins, membranous but covered with scales and hairs, these bearing the colors and patterns.

Metamorphosis complete, the larvae known as caterpillars and often incorrectly as "worms," as in canker-worm and army worm. These are mostly terrestrial and subsist on plant food rarely aquatic and occasionally carnivorous. They have n wings and exhibit mandibulate (chewing) mouthparts. Th customary three pairs of jointed appendages are present, born on the pro-, meso-, and metathorax. These are the true legs an are tapering organs with a chitinous exoskeleton, and ar armed at the tip with a small claw. In addition, temporar larval appendages known as prolegs occur, two to five pairs, a the rear of the abdomen, to support the hind end of the elon gated body and assist in locomotion and clinging to branche and leaves; they are thick and fleshy, without joints, and ar generally provided with a circlet of small sharp hooks terme crochets; they are shed with the last larval skin.

Caterpillars are mostly cylindrical and may be naked, hairy or spiny, the hairs scattered or in tufts; green, brown, or intri cately, often gaily and beautifully marked in many colors an patterns. Frequently there is a high degree of concealing color ation or mimicry of the environment, the mimicry sometime extending to form and habits as well as to color and pattern, a is the case with those species that appear to be parts of a lea margin, or dead twigs. Mimicry is a notable feature amon adults in this order also.

The pupae may be free and mobile, partly so, or completel sheathed as a naked chrysalis or within a silken cocoon, onl the last abdominal segments being movable. The chrysalis ma be attached to vegetation by a caudal process, the cremaster which may in addition have hooks or spines, and may han head downward as in the Mourning Cloak, or head upward, th body encircled for support by a silken girdle, as in the swal lowtails. Many caterpillars pupate in underground burrows the pupae remaining sufficiently active as to make their wa to the surface for emergence of the adult. The eggs of lepi dopterous insects are amazing for the great variation shown i size, form, sculpturing, color, and other features. More abou this great order and slides to make from its members in late installments.

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